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Teacher's Edition for

starting points

in mathematics

Mathematics Team

Level 3

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OUR LADY OF FATIMA SCHOOL
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In each Teacher's Edition of *Starting Points in Mathematics*, the pages for the student's book are referred to by numeral only, while pages in the teacher's edition are designated by the letter T and a numeral.

Authors and Consultants



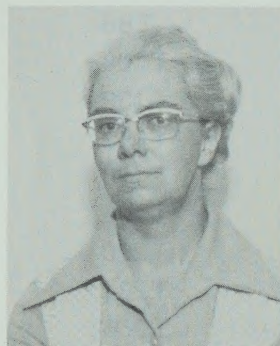
Dr. James E. Beamer

Currently Associate Professor of Mathematics Education at the University of Saskatchewan, Jim has worked closely with the Saskatoon Separate and Public School Boards in developing the mathematics curriculum. He has a Bachelor of Science degree from Parsons College, a Master of Science degree from the University of Notre Dame, and a Doctor of Education degree from the University of Nebraska. He is the author of a number of research papers and publications in North America and has made a major contribution to teacher-in-service work in his home province. He has worked on the program from its beginning, planning the development and evaluating manuscript for the primary phase.



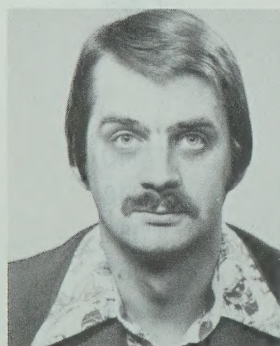
Donald L. Bornhold

Don has a Bachelor of Arts degree from the University of Western Ontario, a Bachelor of Pedagogy degree from the University of Toronto, and courses toward a Ph.D. at Columbia University. His background in mathematics has included teaching elementary and junior-high school in Kitchener and Simcoe; principal in Sherbrooke, Quebec; superintendent in Kirkland Lake, Ontario; inspector and assistant area superintendent of schools for the North York Board of Education; lecturer for the Ontario Department of Education at State College of Victoria, Melbourne, Australia; senior author of another mathematics series. He is the senior author of the program.



Grace Dilley

Grace is currently a Helping Teacher of Mathematics in School District 36, Surrey, British Columbia. She has Bachelor of Education and Master of Arts in Education degrees from the University of British Columbia. Prior to her present position, she was a classroom teacher, and a lecturer at the University of British Columbia. She is active in the British Columbia Association of Mathematics Teachers and is an author of another mathematics series. She has evaluated manuscript for the primary phase of the program.



Emery Dosdall

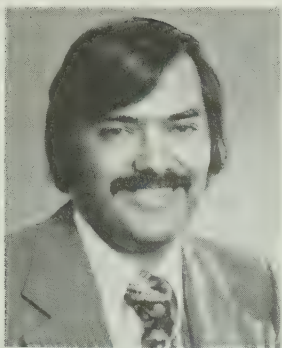
Emery is currently the Director of Program Supervision (K-12) for the Edmonton Public Schools. He has a Bachelor of Education degree and a diploma in Educational Administration from the University of Alberta, and a Master of Education degree from the University of Oregon. Prior to his present appointment, he was Supervisor of Mathematics (K-12), lecturer at the University of Alberta, assistant principal, and consultant. He has worked extensively in elementary mathematics curriculum development for the Edmonton Public Schools and has participated throughout his home province and nationally in the development of mathematics. He has worked on the program from its beginning, evaluating manuscript, consulting at all grade levels, and coordinating and evaluating field-test material prior to publication.



Ralph Gardner

Ralph is currently Principal of Seaview Elementary School in Port Coquitlam, British Columbia, where he is actively teaching mathematics. He has returned to the classroom following a position as Supervisor of Instruction and a position as Mathematics Consultant with the School District of Coquitlam. He has been active in mathematics in a number of capacities — serving on the Provincial Mathematics Committee, developing curriculum in the province, as an author of another mathematics program. He has worked on the program in planning the development, evaluating manuscript, and in field-testing the new approaches.

Authors and Consultants



Robert Gutchner

Bob is currently an Assistant Superintendent with the Metropolitan Toronto Separate School Board, having previously been its Mathematics Coordinator. He has a Bachelor of Arts degree from the University of Western Ontario, a Master of Mathematics degree from the University of Waterloo, and a Master of Education degree from the Ontario Institute for Studies in Education. Prior to his most recent positions, he was head of a mathematics department with the Wellington County R.C.S.S. Board and earlier worked with the Etobicoke and Waterloo County Boards of Education. He has worked on the program in planning the development, evaluating manuscript, consulting at all grade levels, and as the senior author of the Grade 3 material.



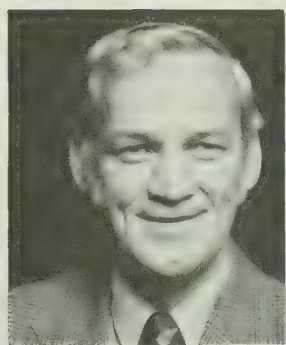
Jean Lewis

Jean is currently School Supervisor of School District 15, Moncton, New Brunswick. She has Bachelor degrees in Education and Elementary Education from the University of Moncton. She has taught extensively in elementary and junior-high schools and was an elementary school principal prior to her present appointment. She is a Past President of the New Brunswick School Supervisors Organization and represented New Brunswick at N.C.T.M. meetings for a number of years. She continues to be active in curriculum development and is an author of other mathematics publications. She has worked on the program in planning the development and evaluating manuscript for the primary phase.



Dr. Murray McPherson

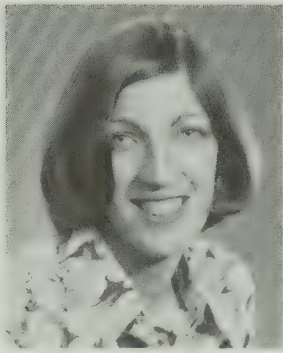
Murray is currently Professor and Head, Department of Curriculum: Mathematics and Natural Sciences, Faculty of Education at the University of Manitoba. He has Bachelor of Science and Master of Education degrees from the University of Manitoba, and a Ph.D. from Michigan State University. Prior to his present appointment, he was a teacher and head of the department of mathematics at St. John's High School, Winnipeg, and a mathematics teacher at Dauphin Collegiate. He is Past President of the Manitoba Association of Mathematics Teachers and has spoken at a number of N.C.T.M. meetings. He has worked on the program in planning its development and evaluating manuscript.



Edward B. Murrin

Ed is currently teaching mathematics at Antigonish Regional High School. Prior to his present teaching responsibilities, he has been an elementary school principal for sixteen years, a Past President of the Nova Scotia Mathematics Teachers Association, and a lecturer in elementary mathematics at St. Francis Xavier University. He was the Canadian representative for the National Council of Teachers of Mathematics from 1972 to 1975 and has been active in mathematics throughout his home province of Nova Scotia for many years. He has worked on the program in planning its development and evaluating manuscript.

Authors and Consultants



Trudy Stacey

Trudy has a Bachelor of Arts degree from York University. She has been an elementary teacher and is currently a General Consultant for the North York Board of Education and Program Leader in Language Arts and Mathematics. She developed the themes for the primary phase of the program.



Stella Tossell

Stella has a Bachelor of Arts degree from the University of Toronto. Her background in mathematics has included teaching at the secondary level with the Lincoln County and York County Boards of Education. After teaching at the American School in Athens, Greece, she resumed her duties with the York County Board of Education and then joined the North York Board of Education in an advisory position at the junior-high level. More recently she has been a Mathematics Consultant mainly at the elementary level for the North York Board of Education. She has worked on the program in evaluating and writing manuscript, and writing teaching suggestions and activities for the teachers.



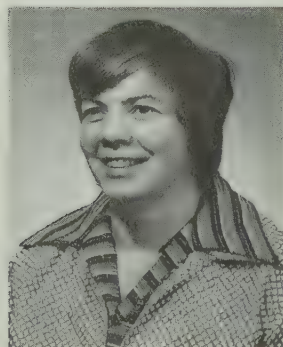
Cathie Traynor

Cathie is a Consultant with the Metropolitan Toronto Separate School Board. A graduate of Lakeshore Teachers College, Toronto, she has continued her education at York University and, through the Ontario and British Ministries of Education, in a number of specialized categories, namely, early childhood education, language development, speech therapy, and special education. She taught in the elementary grades for the Metropolitan Toronto Separate School Board and also the Ontario Ministry curriculum and mathematics courses. She has lectured at York University. She is an author on the program and has coordinated and evaluated the field-test material prior to publication.



Stewart West

Stewart has Bachelor degrees in Arts and Education from the University of New Brunswick and is currently teaching at the Magnetic Hill School in Moncton. He has served in many capacities in the province: as a member of the Provincial Committees in Mathematics and Science; as Conference Chairman for the Association Subject Council Workshop; as President and Workshop Coordinator for Elementary Teachers' Council. He continues to remain active in numerous presentations in his home province, in other centers in Canada, and in the United States. He has worked on the Grade 3 to 6 phase of the program in planning the development, evaluating manuscript, and coordinating and evaluating field-test material prior to publication.



Mary Wright

Mary received her education in England and carried on postgraduate work at Acadia University (M.Sc.), and Dalhousie University. She taught high school in England, New Brunswick, Nova Scotia, and Prince Edward Island. She was a lecturer and assistant professor of mathematics at Acadia University for ten years. Currently, she is a Mathematics Consultant for the Regional Administrative Office of the Department of Education in Montague, Prince Edward Island. She has been active in mathematics in a number of capacities. She is a recipient of a Canada Council Scholarship for Teachers of Mathematics, and a member of the Canadian Mathematics Congress and of N.C.T.M. She has worked on the Grades 4 to 6 phase of the program in planning the development and evaluating manuscript.

Content

Computation strands that maintain a balance between concepts and skills

A metric Measurement strand using units and symbols in accordance with the National Standards of Canada

A Decimals and Fractions strand that reflects the more significant role of decimals in a metric world

A Geometry strand that introduces transformation geometry topics in addition to the more traditional topics

A Problem Solving strand that identifies specific problem solving skills and strategies

Development

Computational concepts and skills built upon the basic facts, the continued manipulation of concrete materials, place value, systematic development of the algorithms, and practice

Measurement concepts and skills introduced using non-standard units; refined and developed using only approved metric units

Decimals introduced with the parts-of-a-whole concept and developed by extending the place-value concepts of whole numbers

Corresponding ideas among the Numeration, Computation, Measurement, and Decimals strands treated as mutually supportive concepts for both development and reinforcement

Problem Solving strand integrated with the other strands

Material provided for maintenance of computational skills

For the Student

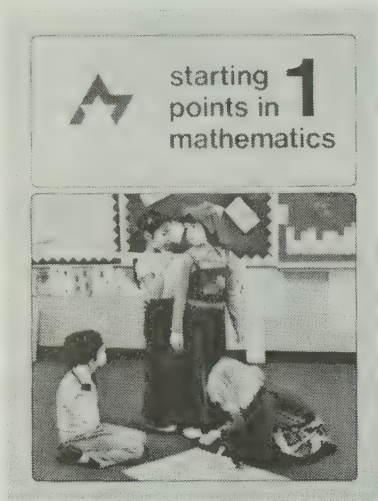
- A highly visual program placing mathematics ideas and experiences within meaningful settings of real-life objects and situations
- Uniform lesson structure with completed examples to illustrate each objective
- A variety of types of exercises
- Problems that provide reasons for learning mathematics
- *Special Features* showing mathematics in use in real-life situations and providing opportunities to be individually creative with mathematical skills in problem solving and enrichment activities

For the Teacher

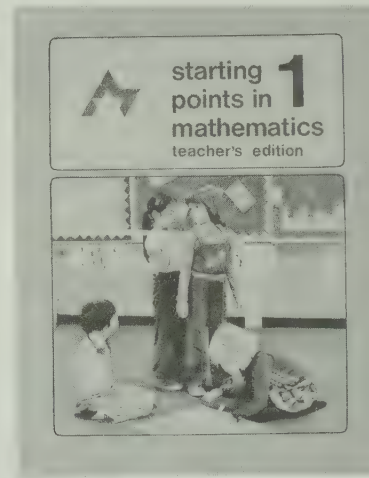
- Manageable units for the development of concepts and skills
- Overviews that provide mathematics background and summarize the content of each unit
- Concise statements of lesson objectives
- Suggestions for activities to precede and follow each lesson in the book; suggestions for teaching each lesson in the book
- Uniform lesson structure that is adaptable to a variety of classroom strategies
- Unit themes that support the integration of mathematics with other areas of study, and suggestions on how this integration can be achieved
- Component skills necessary for achieving lesson objectives identified
- Assessment materials included in the book and the teacher's edition

starting points in mathematics

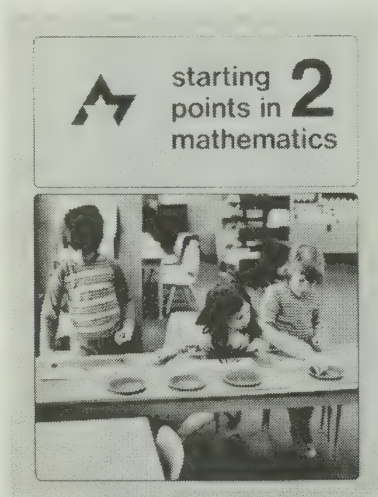
Grade 1 Student's Book



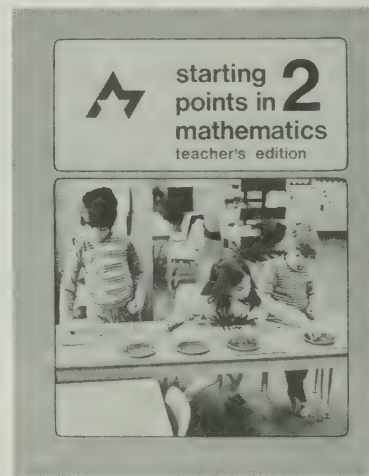
Grade 1 Teacher's Edition



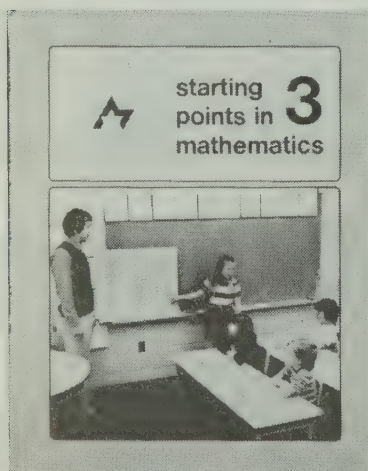
Grade 2 Student's Book



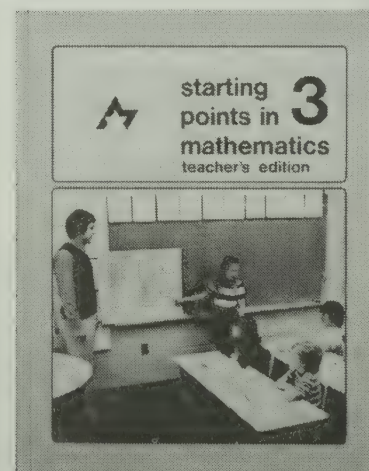
Grade 2 Teacher's Edition



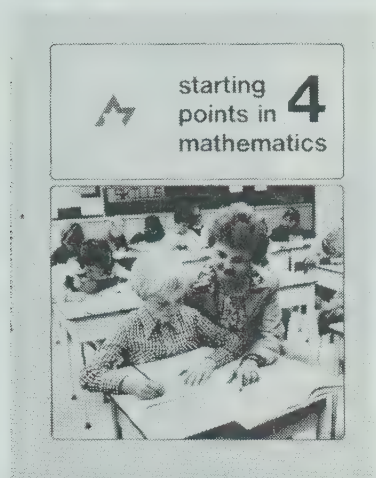
Grade 3 Student's Book



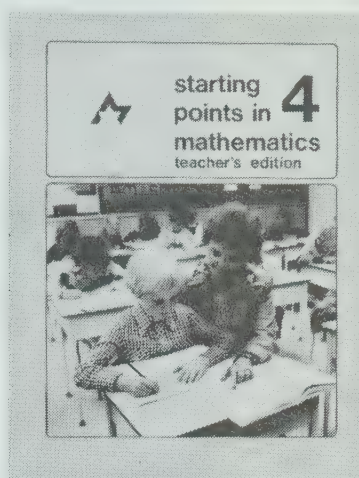
Grade 3 Teacher's Edition



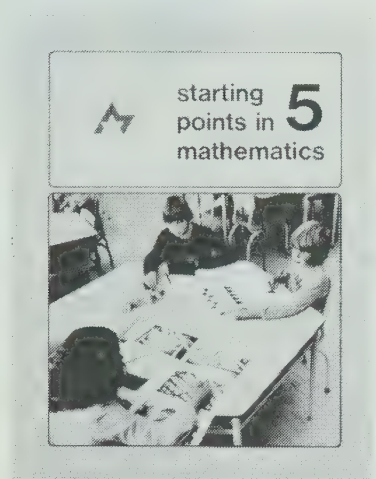
Grade 4 Student's Book



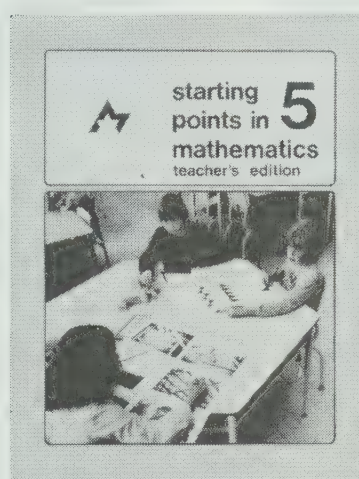
Grade 4 Teacher's Edition



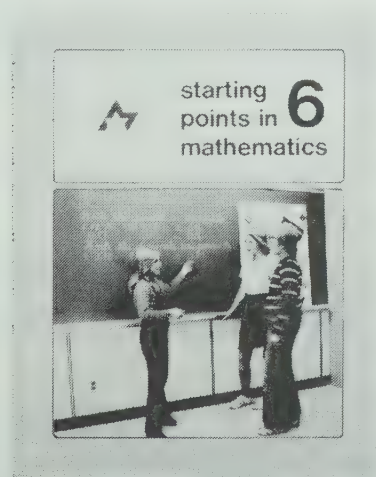
Grade 5 Student's Book



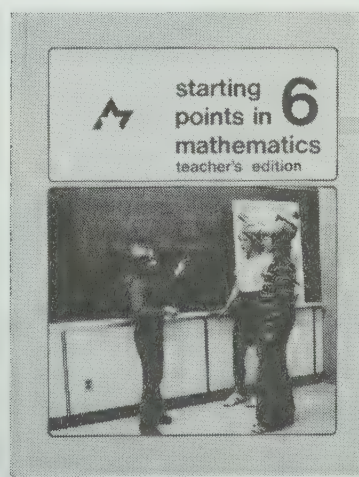
Grade 5 Teacher's Edition



Grade 6 Student's Book



Grade 6 Teacher's Edition



Lesson outcome is stated.

A lesson begins with a worked example of what is to be learned.

Color and design are used to assist understanding.

Working Together shows the steps of what is to be learned.

Using Addition to Check Subtraction

Subtract 726 and add to check.
 - 478

Subtract.

 11
 6 16
726
- 478

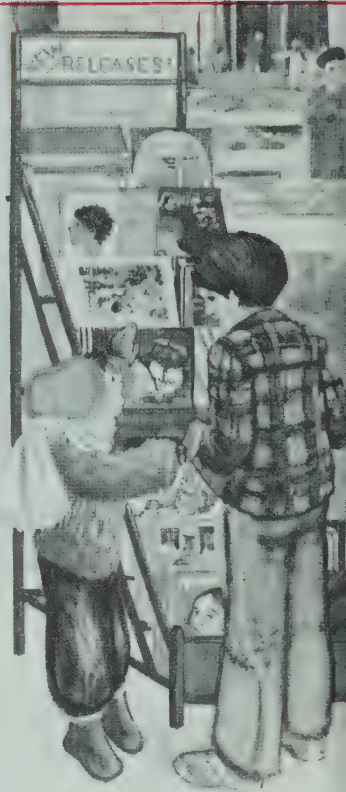
248

Add to check.

 1 1
248
+ 478

726

This sum should match the first number used in the subtraction. If they do not match, there is a mistake.



Working Together

Add to check each subtraction.
Do the subtraction again if you find a mistake.

1. Subtract. Add to check.

 765
- 231

534

 534
+ 231

765

2. Subtract. Add to check.

 511
1387
- 524

863

 863
+ 524

1387

3. Subtract. Add to check.

 610
1708
- 743

965

 965
+ 743

1708

Be careful!

Subtract. Add to check.

4. 294
 - 26

5. 910
 - 427

6. 1336
 - 491

7. \$19.16
 - 9.60

The development of a concept enables the child to move from the use of concrete materials to the use of abstract number sentences and algorithms.

Special Features

Practice with addition, subtraction, multiplication, and division

KEEPING SHARP

Some interesting ideas for fun and enrichment

try this

Lessons and activities to help in learning the skills needed for solving problems

PROBLEM SOLVING

RECORDS

RECORDS MARKED "A" \$3.99

RECORDS MARKED "B" \$4.96

RECORDS MARKED "C" \$6.99

Exercises

The table shows record sales for one month. Subtract to complete the table. Add to check each subtraction.

	1. "A" Records	2. "B" Records	3. "C" Records
Number at start of month	1735	1481	1360
Number at end of month	982	557	673
Number sold in the month	?	?	?

Solve. Add to check each subtraction.

4. 924 "B" records were sold. 687 "C" records were sold. How many more "B" records were sold?

5. 753 "A" records were sold. 924 "B" records were sold. How many fewer "A" records were sold?

Subtract. Add to check.

$$\begin{array}{r} 6. \quad 71 \\ - 25 \\ \hline \end{array}$$

$$\begin{array}{r} 7. \quad 211 \\ - 59 \\ \hline \end{array}$$

$$\begin{array}{r} 8. \quad 779 \\ - 388 \\ \hline \end{array}$$

$$\begin{array}{r} 9. \quad 1592 \\ - 853 \\ \hline \end{array}$$

$$\begin{array}{r} 10. \quad \$8.33 \\ - 4.84 \\ \hline \end{array}$$

$$\begin{array}{r} 11. \quad \$14.62 \\ - 6.97 \\ \hline \end{array}$$

245

Exercises give practice and provide applications of what has been learned.

Word problems whose solutions incorporate the skills taught are included.

Wherever possible, the integrating themes of the units are incorporated into the development of concepts.

Special * exercises provide more practice with problem solving.

Checking Up

End-of-unit lessons provide a check of the understanding of the work of the unit.

Checking Skills

Special reviews provide a check of skills with addition, subtraction, multiplication, and division.

Features of the Teacher's Edition

A lesson outline may include some or all of the following:

- 1 The page references to the student's book
- 2 The outcome(s) for the lesson
- 3 Some of the materials that would be desirable for introducing and developing the lesson
- 4 A reference to a page that may be copied to provide cutouts for the children
- 5 Mathematical terms used for the first time and other words useful for discussing the development of the topic on the page
- 6 Identification of concepts and skills that children should be able to perform prior to the lesson
- 7 Suggested tasks for assessing prerequisite skills
- 8 Comments about the content of the lesson
- 9 Activities for developing the lesson concepts, and suggestions for introducing new words and symbols

1 Pages 48-49

2 LESSON OUTCOME

Add numbers with no regrouping, sums to 999

3 Materials

models for 9 hundreds, 9 tens, and 9 ones for each child (see page T 361)

4

5 Vocabulary

vertical form

6 Prerequisite Skills

Complete basic addition facts, sums to 9

7 Checking Prerequisite Skills

Add.

$$\begin{array}{r} 1. \quad 7 \\ + 2 \\ \hline 9 \end{array} \quad \begin{array}{r} 2. \quad 3 \\ + 3 \\ \hline 6 \end{array} \quad \begin{array}{r} 3. \quad 5 \\ + 4 \\ \hline 9 \end{array}$$

- 8 *Note:* The development of the first example on page 48 is typical of the other examples throughout the book in which models are used. The instructions, the color on the numerals, and the illustrations of models are coordinated to show the step-by-step procedure for the operation. This method enables children to follow each step of the procedure. The method also relates each step of the procedure to the children's experience with the concrete models they used before discussing the page.

3 ADDITION

No Regrouping

Add 52 and 34

tens	ones
5	2
+ 3 4	
8	6

Show 52 and 34 with their tens and ones lined up in vertical form.

tens	ones
5	2
+ 3 4	
	6

Add the ones.

tens	ones
5	2
+ 3 4	
8	6

Add the tens.

The sum 52 + 34 is 86.

Add 215 and 364

Add ones

tens	ones
2	1
+ 3 6 4	
	9

Add tens

tens	ones
2	1
+ 3 6 4	
7	9

Add hundreds

tens	ones
2	1
+ 3 6 4	
5	7

215 plus 364 equals 579.

48

LESSON ACTIVITY

9 Before Using the Pages

- Review place value by discussing numerals having two and three digits as follows. Write each numeral on the board. Have the children use their models to represent each number. Ask for and record the number of ones, the number of tens, and then the number of hundreds on a place-value chart.
- Introduce joining models to represent addition in the following way. Have the children represent a two-digit number with their models. Ask for and record the number of ones, and then the number of tens as an addend on a place-value chart as shown. Repeat this for the other addend.
Have the children join their models for the ones. Ask for and record the number of ones in all. Repeat this for the tens. Ask for the number represented by this many tens and ones. Record the numeral under the chart as shown.

tens	ones
2	3
+ 4	3
6	6

Repeat this procedure with a few exercises having three-digit addends.

Using the Pages

- As stated in the *Note* above, each step of the procedure is shown separately. Have the children examine how the illustrations of models, the red on the numerals, and the instructions are coordinated for each step of the first worked example. Then have them examine how the red on the numerals and the instructions are coordinated for each step of the second worked example.

T 52

10

10 Suggestions for using the pages

Overviews

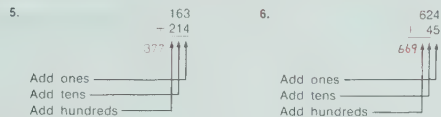
The overview at the beginning of each unit includes a list of the prerequisite skills that are required for successful completion of the unit, the outcomes for the developmental lessons in the unit, mathematical background, comments about the content and how the unit fits with the other units in the program, teaching strategies, materials, and vocabulary.

Working Together

Line up the hundreds, tens, and ones in vertical form

- $14 + 12$ $\begin{array}{r} 14 \\ +12 \\ \hline \end{array}$
- $41 + 8$ $\begin{array}{r} 41 \\ +8 \\ \hline \end{array}$
- $148 + 130$ $\begin{array}{r} 148 \\ +130 \\ \hline \end{array}$
- $212 + 65$ $\begin{array}{r} 212 \\ +65 \\ \hline \end{array}$

Follow the steps



Add

- $31 - 24$ $\begin{array}{r} 31 \\ -24 \\ \hline \end{array}$
- $332 - 356$ $\begin{array}{r} 332 \\ -356 \\ \hline \end{array}$
- $114 + 74$ $\begin{array}{r} 114 \\ +74 \\ \hline \end{array}$
- $304 - 393$ $\begin{array}{r} 304 \\ -393 \\ \hline \end{array}$

Exercises

Show the numbers in vertical form and add

- $31 + 52$ $\begin{array}{r} 31 \\ +52 \\ \hline \end{array}$
- $30 + 43$ $\begin{array}{r} 30 \\ +43 \\ \hline \end{array}$
- $16 + 50$ $\begin{array}{r} 16 \\ +50 \\ \hline \end{array}$
- $54 + 2$ $\begin{array}{r} 54 \\ +2 \\ \hline \end{array}$
- $239 - 30$ $\begin{array}{r} 239 \\ -30 \\ \hline \end{array}$
- $417 + 242$ $\begin{array}{r} 417 \\ +242 \\ \hline \end{array}$
- $821 + 148$ $\begin{array}{r} 821 \\ +148 \\ \hline \end{array}$
- $453 - 6$ $\begin{array}{r} 453 \\ -6 \\ \hline \end{array}$

Add

- $\begin{array}{r} 24 \\ +45 \\ \hline \end{array}$
- $\begin{array}{r} 36 \\ +12 \\ \hline \end{array}$
- $\begin{array}{r} 52 \\ +43 \\ \hline \end{array}$
- $\begin{array}{r} 85 \\ +4 \\ \hline \end{array}$
- $\begin{array}{r} 80 \\ +17 \\ \hline \end{array}$
- $\begin{array}{r} 44 \\ +44 \\ \hline \end{array}$
- $\begin{array}{r} 270 \\ +318 \\ \hline \end{array}$
- $\begin{array}{r} 166 \\ +21 \\ \hline \end{array}$
- $\begin{array}{r} 322 \\ +167 \\ \hline \end{array}$
- $\begin{array}{r} 157 \\ +330 \\ \hline \end{array}$
- $\begin{array}{r} 88 \\ +16 \\ \hline \end{array}$
- $\begin{array}{r} 452 \\ +5 \\ \hline \end{array}$
- $\begin{array}{r} 187 \\ +92 \\ \hline \end{array}$
- $\begin{array}{r} 50 \\ +40 \\ \hline \end{array}$
- $\begin{array}{r} 500 \\ +200 \\ \hline \end{array}$
- $\begin{array}{r} 232 \\ +16 \\ \hline \end{array}$
- $\begin{array}{r} 53 \\ +57 \\ \hline \end{array}$
- $\begin{array}{r} 102 \\ +541 \\ \hline \end{array}$
- $\begin{array}{r} 225 \\ +271 \\ \hline \end{array}$
- $\begin{array}{r} 340 \\ -16 \\ \hline \end{array}$
- $\begin{array}{r} 715 \\ +73 \\ \hline \end{array}$
- $\begin{array}{r} 53 \\ +26 \\ \hline \end{array}$
- $\begin{array}{r} 102 \\ +541 \\ \hline \end{array}$
- $\begin{array}{r} 225 \\ +271 \\ \hline \end{array}$
- $\begin{array}{r} 340 \\ -16 \\ \hline \end{array}$

- To emphasize the value of writing the numerals in vertical form for addition, write exercises similar to the following on the board.

$$\begin{array}{r} 481 \\ +513 \\ \hline \end{array} \quad \begin{array}{r} 481 \\ +513 \\ \hline \end{array} \quad \begin{array}{r} 481 \\ +513 \\ \hline \end{array} \quad \begin{array}{r} 481 + 513 \end{array}$$

Have the children choose which form makes addition easiest. Lead them to suggest that writing the numerals in vertical form facilitates adding the ones with the ones, the tens with the tens, and the hundreds with the hundreds.

Working Together: Emphasize the two main skills in this lesson:

lining up the hundreds, tens, and ones in vertical form; adding the ones, then the tens, and then the hundreds.

For Ex. 7-10 have the children think of these two main skills as they write the exercises and add. Provide similar exercises as needed.

Exercises: You may wish to remind the children to write Ex. 1-8 in vertical form.

RELATED ACTIVITIES

- Children may enjoy finding the hidden "bingo". Prepare copies of the following chart. Children complete the exercises in any order. Each sum is marked with an X on the chart when it is found. The children may stop work when they find the hidden "bingo" (4 sums in a row, a column, or a diagonal).

23	218	548	36
134	475	48	626
87	69	177	259
356	162	94	436

$$\begin{array}{r} 41 \\ +121 \\ \hline \end{array} \quad \begin{array}{r} 12 \\ +24 \\ \hline \end{array} \quad \begin{array}{r} 20 \\ +3 \\ \hline \end{array}$$

$$\begin{array}{r} 162 \\ +114 \\ \hline \end{array} \quad \begin{array}{r} 36 \\ +131 \\ \hline \end{array} \quad \begin{array}{r} 23 \\ +12 \\ \hline \end{array}$$

$$\begin{array}{r} 322 \\ +436 \\ \hline \end{array} \quad \begin{array}{r} 46 \\ +177 \\ \hline \end{array} \quad \begin{array}{r} 82 \\ +94 \\ \hline \end{array}$$

$$\begin{array}{r} 302 \\ +324 \\ \hline \end{array} \quad \begin{array}{r} 233 \\ +242 \\ \hline \end{array} \quad \begin{array}{r} 33 \\ +54 \\ \hline \end{array}$$

$$\begin{array}{r} 626 \\ +118 \\ \hline \end{array} \quad \begin{array}{r} 475 \\ +102 \\ \hline \end{array} \quad \begin{array}{r} 87 \\ +43 \\ \hline \end{array}$$

$$\begin{array}{r} 430 \\ +548 \\ \hline \end{array} \quad \begin{array}{r} 32 \\ +134 \\ \hline \end{array} \quad \begin{array}{r} 27 \\ +70 \\ \hline \end{array}$$

Assessment

Add

- $82 + 4$ $\begin{array}{r} 82 \\ +4 \\ \hline \end{array}$
- $740 + 36$ $\begin{array}{r} 740 \\ +36 \\ \hline \end{array}$
- $\begin{array}{r} 235 \\ +162 \\ \hline \end{array}$
- $\begin{array}{r} 30 \\ +50 \\ \hline \end{array}$
- $\begin{array}{r} 324 \\ +274 \\ \hline \end{array}$

- Suggested activities and games which may be used to reinforce, extend, or enrich a particular topic

- Illustrations of suggested materials

- Reduced pages from the student's book with answers indicated

- Exercises to evaluate the learning outcome

Answers

Answers for the exercises are given on each reduced page from the student's book.

Other Materials

Themes
Games and Teaching Aids
Pages for Reproduction
Year-End Evaluation Chart
Index for Student's Book

Teaching Strategies

Using the Introductory Material

Knowing what the *Starting Points in Mathematics* program can do and what it cannot do is an important place to begin. There are two features to help you. First, the Scope and Sequence chart shows the content by grade level and allows you to locate particular topics in the overall development. Secondly, each unit begins with an overview which summarizes the content of the unit, includes mathematics background for the teacher, and suggests strategies for class organization and teaching.

Presenting the Lessons

The organization of the teaching suggestions for each lesson has built-in strategies to motivate and teach, and for practice and application. The identification of *Prerequisite Skills* and concepts are stated in terms of tasks children should be able to perform prior to the lesson. Teachers will want to assess prerequisite skills in certain instances; for example,

- for topics that have proven traditionally difficult,
- for mathematics topics in the curriculum,
- with children who have missed school or been transferred,
- at the beginning of the year when the mathematical levels of the children may be uncertain,
- as a starting point to work with children who have not been successful with the lesson.

In the *Before Using the Page(s)* section, almost all lessons are initiated with concrete material to provide a review, an appropriate warm-up, or activities designed to lead children to discover a concept or a skill.

The teaching suggestions in the *Using the Page(s)* section emphasize the key aspects of the teaching example and, at times, suggest a possible sequence. When children are ready to work the exercises independently, they will benefit from a full explanation of the teaching example as a guide for their work. The teaching suggestions follow naturally from the preliminary activities and allow you to develop the lesson outcomes from the students' page(s).

In all teaching lessons, the *Working Together* section provides an examination of the sub-skills and/or the sequence of steps leading to the outcome. This section allows for immediate feedback of the children's understanding of the lesson. In this regard, this section may be completed orally or on the board. Children experiencing difficulty with the exercises can be referred to the appropriate example. *Working Together* provides another opportunity to see how all the steps of the lesson combine and, consequently, provide a means for diagnosing the children's understanding.

Each teaching lesson provides material in the *Assessment* section to evaluate the learning outcome.

Most of the *Related Activities* can be used for all the children. The suggestions in this section try to provide a balance between reinforcement, enrichment, and review.

Grouping for Instruction

Knowing what to teach is one thing, knowing how to adapt a program for individual differences in ability and capacity for achievement is the ongoing role of all teachers.

It is possible to work with lower achievers and higher achievers by using the same material but by altering the teaching

procedure. Lower achievers, as in other subjects, need a slower pace to provide for maximum use of concrete materials and pictorial representations as well as varied activities to ensure understanding.

With higher achievers you will often wish to move at a faster pace. This does not mean a more rapid movement through the lessons, but rather a change in approach. All children need the benefits derived from the use of concrete materials for both present and future understandings, but higher achievers tend to move more readily from the concrete to the abstract levels of mathematical thinking. They grasp concepts and skills quickly and will benefit from exploration and challenges that will allow them to use and broaden their newly acquired abilities in different settings.

Grouping for instruction is dependent on a number of factors, including teacher preference, teaching strategy, social and academic needs of children, abilities and skills of the children, the need to vary instruction, the organization of the classroom. Some possible ways for grouping are:

The Whole Class

Instruction of the whole class is appropriate for the introduction of new topics or class projects.

Skill Groups

For this grouping the teacher selects children having similar needs for the teaching of a specific skill. When the skill is mastered, the group is dissolved.

Interest Groups

For this grouping the child chooses to be a member of the group based on interest in the activity being offered. For example, while one concept is being explored by the whole class, a child may have the choice of working at the board or with activity cards. This kind of grouping promotes sharing among children and offers opportunities for children to display leadership.

Random Groups

This type of grouping may be as arbitrary as the grouping of all children wearing something red or as open as to include pairs of friends. It is especially suited to situations involving games, experiments, and making things, for example, models of three-dimensional shapes.

Often children may be part of a group, but they may work independently within the group. It is here that the teacher may observe and plan for individual needs. By moving from group to group, the teacher may evaluate and assess performance as well as direct and guide learning.

Providing for Individual Differences

Use the daily performance and test results to assess the needs and abilities of the children.

For lower achievers, plan to make more extensive use of the *Prerequisite Skills* assessment before starting a lesson, the *Working Together* section, and the appropriate selection of activities from the *Related Activities*. The *Keeping Sharp* sections provide continued practice for the basic operations.

Higher achievers will benefit from the flexibility and variation of the teaching model and a wider exposure to the special features, *Try This* and *Problem Solving*. The *Related Activities* provide suggestions for enrichment topics.

All children will benefit from the twelve formal lessons on problem solving found at the end of Units 1, 2, 3, 5, 6, 8, 9, 11, 12, 13, 15, and 16.

Problem Solving

The problem solving strand is integrated and interspersed throughout *Starting Points in Mathematics 3*. There are twelve teaching lessons on specific skills, eleven special feature sections presenting problems as extensions of material under study, and starred problems that require special attention or integrate what has been learned in the problem solving lessons to the exercises.

Children will benefit from specific instruction on problem solving, the concrete presentation of concepts and skills in all the lessons where this is possible, and meeting problem solving requirements in a meaningful context. The material in this strand, however, is by no means exhaustive. Teachers will capture the right moments in their daily contact with the children to provide the insights and skills to develop better problem solving techniques.

Testing and Evaluation

The *Checking Up* page at the end of each unit reviews the skills taught in the unit and helps to evaluate the children's progress. It could also be used as a pretest for the unit.

The chart in the teacher's edition for each *Checking Up* page is designed to help locate strengths and weaknesses. The *Skills* section of the chart lists the skills taught in the unit. The *Exercises* section lists the exercises on the *Checking Up* page corresponding to each skill identified. The *Related Pages* section lists the pages in the teacher's edition where the skill is taught. You may wish to refer to these pages for reviewing or reteaching.

The comments below the chart discuss special aspects of the exercises. They point out possible difficulties and give suggestions for remedying the difficulties.

Children who demonstrate an understanding of the concepts may benefit by using enrichment activities described in the teaching suggestions for the unit.

The *Checking Skills* pages at the end of Units 4, 7, 10, and 14 evaluate children's ongoing performance in the four basic operations.

Many lesson outcomes can be and are evaluated by working with children on a daily basis. The children's oral responses, work on the board, and written assignments provide ongoing evaluation including outcomes not measured by tests, for example, attitudes and work habits.

If evaluation is to be an ongoing process, it is important to keep complete and accurate records of the achievement of each child. A file containing remarks on progress based on the observation of the teacher and samples of the child's work is recommended. The remarks can be dated and are an excellent reference when reporting to parents. The samples of work can be selected by both the teacher and the child. If the child plays an active part in contributing work which indicates her/his mastery of a concept, she/he also recognizes that learning is important. This is an essential factor in assuring future success.

The comprehensive evaluation chart on pages T 369 and T 370 is intended for use at the end of the school year, but it may be adapted for other uses. For example, if the indicated program is too ambitious for all the children in a class, the chart may be used as a guide for obtaining a minimum program or an average program for the children. The format of the chart may also be adapted as a report to show parents the progress their children have made.

A Thematic Approach to Mathematics

Six units of *Starting Points in Mathematics 3* have been considered from a thematic aspect. The considerations given to this aspect of curriculum planning did not alter the mathematics, but did provide opportunities to enhance the teaching strategies.

Teachers who attempt to provide an integrated curriculum frequently encounter difficulty interweaving the mathematics curriculum with other subjects and in creating sufficient real-life situations to make the association a meaningful one. The thematic organization is provided to assist those teachers who wish to organize their teaching in this manner. The themes have been selected

- to appeal to a wide range of children's interests,
- to provide suitable topics for integrating the curriculum,
- to suggest real-life situations that provide a framework for mathematical understanding.

Teachers who have never tried integrating mathematics may wish to experiment with one or more of the themes suggested. They may be surprised that there are practical aspects in using a thematic approach. For example, time can often be used more efficiently by integrating several subject areas. This approach also facilitates the planning of activities when working within the framework of a topic. Resources and materials required may serve several purposes; for example, art materials may be used as a method for communicating mathematical concepts.

The themes are prevalent in the visual material shown in each unit. Where possible, the concrete materials used in the teaching of a concept or in placing the mathematical problem in a social setting are chosen to fit the theme. In addition to this visual link, the teaching suggestions may include ideas on how to integrate the theme for a unit. The children may also make suggestions for activities they wish to explore. Involving the children in planning the activities within a theme is a valuable learning experience for them, and enables the teacher to observe and assess each child's development.

The themes for *Starting Points in Mathematics 3* are outlined below.

- | | |
|---------|---|
| Unit 1 | The Supermarket: its role; visiting; exploring sizes of containers, packaging, comparative shopping, planning meals; displaying products, attracting customers; foods from around the world |
| Unit 2 | Fairy Tales: characteristics; comparisons with reality; graphing favorite tales and characters; tales and their origins; classifying information; dramatizing and illustrating |
| Unit 3 | The School: physical construction; mapping and making models; roles of those associated with the school; learning materials; school activities |
| Unit 5 | Transportation: classifying vehicles; traffic problems and controls; traffic safety |
| Unit 8 | At the Fair: purpose of a fair; cultural traditions; classifying activities; making comparisons; interpretations |
| Unit 12 | Conservation: investigating soil, ponds, swamps, forests, fields; controlling the environment; enjoying the environment |

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Scope and Sequence

Grade 2

NUMBER AND NUMERATION

Read, write numerals from 0 to 999
Place value for three-digit numbers, regrouping between tens and ones
Order, compare numbers to 999
Ordinal number concepts to *tenth*

ADDITION

Basic facts, sums to 18
Families of related basic facts
Algorithm with regrouping, sums to 99
Algorithm with regrouping, sums to 999 (optional)
Add amounts of money, sums to 99¢
Add to check subtraction

SUBTRACTION

Basic facts, minuends to 18
Families of related basic facts
Algorithm with regrouping, minuends to 99
Algorithm with regrouping, minuends to 999 (optional)
Subtract amounts of money, minuends to 99¢

MULTIPLICATION

Facts of 2, 5, 10
Write multiplication sentences

DIVISION

Group to show halves, thirds, fourths, tenths
Group by 2's, 5's, and 10's

DECIMALS AND FRACTIONS

Halves, thirds, fourths, tenths of a whole
One-third, one-fourth of a set

Grade 3

Read, write numerals from 0 to 9999
Place value for four-digit numbers, regrouping among the places
Compare, order numbers to 9999
Expanded form
Ordinal number concepts to *thirty-first*

Algorithm, three-digit addends, four-digit sums
Algorithm with three addends
Add amounts of money, sums less than \$50.00
Add decimal tenths

Algorithm, four-digit minuends, three-digit differences
Check by addition
Subtract amounts of money, minuends less than \$50.00
Subtract decimal tenths

Basic facts
Write multiplication sentences
Order of factors
Related multiplication, division facts
Algorithm, two-digit multiplicand, one-digit multiplier

Basic facts
Write division sentences
Related division, multiplication facts
Introduction to algorithm, remainders

Mixed form with halves, thirds, fourths, tenths for wholes and parts of wholes
Halves, thirds, fourths, tenths of a set
Decimal tenths and hundredths of a whole
Place value for decimal tenths
Compare, order decimal tenths
Add, subtract decimal tenths

Grade 4

Read, write numerals to 999 999
Place value for six-digit numbers
Compare, order numbers to 999 999
Ordinal number concepts to 999
Round in tens' place, in hundreds' place, in thousands' place
Roman numerals for 1 to 100

Algorithm, four-digit addends
Algorithm, three or more addends
Add decimals, to hundredths
Round addends, estimate sum; compute result and compare sums
Add amounts of money
Add proper or mixed-form fractions with like denominators, no regrouping or whole-number sum

Algorithm, four-digit minuends, four-digit subtrahends
Check by addition
Subtract decimals, to hundredths
Subtract proper or mixed-form fractions with like denominators, no regrouping
Subtract amounts of money

Algorithm, multiplicand to three digits, multiplier to two digits
Multiply up to four one-digit numbers
Determine missing factor in multiplication fact
Multiply one-place decimal by one-digit whole number
Round three-digit multiplicand in its greatest place and multiply by one-digit multiplier to estimate product
Round decimal multiplicand to nearest whole number and multiply to estimate product
Multiply amounts of money
Identify multiples of numbers

Algorithm, to three-digit dividend, one-digit divisor
Check by multiplying
Divide whole-dollar amounts
Find average of set of numbers

Proper and mixed-form halves, thirds, fourths, fifths, tenths, hundredths for part-of-whole and part-of-set models

Equivalent decimal tenths, hundredths with part-of-whole model

Place value for decimals to hundredths; regrouping
Equivalent decimals and proper and mixed-form fractions (100, 10, 4, 2 as denominators)
Compare, order decimals to hundredths
Add, subtract decimals, to hundredths
Multiply one-place decimal by one-digit whole number
Round decimal to nearest whole number, estimate sum or product
Compare and order fractions using decimal equivalents and models
Add, subtract proper or mixed-form fractions with like denominators, no regrouping or whole-number sum

PROBLEM SOLVING

MEASUREMENT

GEOMETRY

GRAPHING

Grade 2

Manipulate sets of objects
Complete the concluding statement incorporating the answer
One-step and two-step computations; addition and/or subtraction

Money: amounts to \$1.99
Time: quarter hour, five-minute marks, intervals of one minute, calendar
Read, record temperature
The metre, decimetre, centimetre; the litre; the kilogram
Estimate length, mass, capacity
Count for area and volume
The distance around a shape

Match identical shapes
Know properties of two-dimensional and three-dimensional shapes
Identify shapes having line symmetry
Slide, turn, and flip images

Complete and draw bar graphs
Interpret pictographs

Grade 3

Draw pictures and diagrams
Multiple-step solutions; addition, subtraction, comparison
Write concluding statements
Identify relevant, irrelevant, missing information
Guess and test
Multiple solutions
Recognize answers as reasonable

Money: amounts less than \$50.00
Time: the nearest minute; dates from the calendar
The metre, decimetre, and centimetre with decimals
Kilometres, grams, millilitres
The square centimetre, the cubic centimetre
Estimate and check length, mass, capacity
Find perimeter

Recognize similar shapes
Recognize, draw, compare line segments
Triangles, rectangles, squares, pentagons, hexagons, octagons
Cubes, prisms, pyramids, cones, cylinders, spheres
Faces, edges, vertices
Create slide, turn, and flip images; patterns
Create shapes having line symmetry
Associate ordered pairs of numbers and points on a grid

Gather and organize information in bar graphs
Create and interpret pictographs
Complete line graphs

Grade 4

Use models to obtain solutions
Choose the operation needed
Identify relevant, irrelevant, missing information
Write an equation for a word problem
Multiple-step solutions; addition, subtraction, multiplication, comparison
Estimate answers
Recognize answers as reasonable
Guess and test
Multiple solutions
Read scales
Organize data
Logical thinking

Estimate and measure; choose the preferred linear unit
Convert between kilometres and metres; metres and centimetres
Measure and add to find perimeter
Count, estimate, and calculate the number of centimetre squares; give area in square centimetres
Count, estimate the number of square centimetres; calculate area in square centimetres, square decimetres, or square metres
Count the number of cubic centimetres; compare objects to centimetre cube, decimetre cube, metre cube
Compare small amounts of time, of length, of mass, of capacity
Classify capacities in comparison with 1 mL, 500 mL, 1000 mL
Classify masses in comparison with 1 g, 500 g, 1000 g
Convert among units of time; choose preferred unit of time
Tell and record time to the nearest minute using 12-hour and 24-hour clock; add, subtract time using 24-hour clock

Identify, name, and draw lines, line segments and their end points
Identify, name, and draw angles; identify and draw right angles
Compare angles to right angles
Identify, name, and draw triangles; identify and name sides and angles of triangles
Identify and draw polygons; identify and name sides and angles of polygons
Identify and draw circles; identify and name parts of circle
Recognize patterns for, and properties of, solids
Using tracing paper to test for congruency in general and under a slide, flip, or turn on a grid
Identify and check line of symmetry as a flip line; identify multiple lines of symmetry (on a grid)
Associate ordered pairs of numbers (including 0 as a coordinate) and points on a grid

Interpret pictographs and bar graphs
Gather and organize information in pictographs and bar graphs
Interpret and draw line graphs

Unit 1 ADDITION AND SUBTRACTION FACTS

Addition facts, sums to 10	2-5
Subtraction facts, minuends to 10	6-9
Addition facts, sums to 18	10-11
Subtraction facts, minuends to 18	12-13
Addition and subtraction practice	14-15
Related facts	16-19
Adding three numbers	20-21
Thinking of a picture	22
CHECKING UP	23

Unit 2 NUMERATION

Numbers to 999	24-27
Expanded form	28-29
Regrouping	30-31
Comparing and ordering numbers	32-33
Practice with number patterns	34
Naming amounts of money	35
Fractions: part of a whole	36-39
Ordinal numbers	40-41
Using a calendar	42-43
Telling time at five-minute marks	44-45
Problems without numbers	46
CHECKING UP	47

Unit 3 ADDITION

No regrouping, sums to 999	48-49
Regrouping ones	50-51
Addition patterns	52
Adding three numbers	53
Addition practice	54-55
Regrouping tens, practice	56-59
Two regroupings, practice	60-63
Adding amounts of money	64-65
IPS Too much information	66
CHECKING UP	67

Unit 4 GEOMETRY

Likenesses and differences	68-69
Solids	70-71
Faces and their shapes	72-73
Edges and vertices	74-75
Line segments	76-77
CHECKING UP	78
CHECKING SKILLS	79

Unit 5 SUBTRACTION

No regrouping, minuends to 999	80-81
Regrouping tens, practice	82-85
Regrouping hundreds, practice	86-89
Two regroupings, practice	90-93
Regrouping with zero	94-95
Subtracting amounts of money	96-97
IPS Solving problems in two steps	98
CHECKING UP	99

Unit 6 MEASUREMENT

Length in centimetres	100-103
Finding perimeter	104-105
Length in decimetres	106-107
Length in metres	108-109
Metres, decimetres, centimetres	110-111
Capacity in litres	112-113
Mass in kilograms	114-115
Temperature in degrees Celsius	116-117
Telling time to the minute	118-119
IPS Does the answer make sense?	120
CHECKING UP	121


Unit 7 DECIMALS

Using decimals to show tenths	122-126
Decimals and number lines	127
Comparing and ordering decimals	128-129
Decimals and place value	130-131
Adding decimals	132-133
Decimetres, centimetres, decimals	134-135
CHECKING UP	136
CHECKING SKILLS	137-139

Unit 8 MULTIPLICATION

Repeated addition	140-141
Writing multiplication sentences	142-143
Multiplication on the number line, exploring facts of 2 and 3	144-145
Displaying factors and products	146-147
Exploring 4 and 5 as factors	148-150
Exploring 0 and 1 as factors	151
Multiplication practice	152-153
Order of factors, arrays	154-157
Multiplication practice	158-159
IPS Drawing pictures	160
CHECKING UP	161


Unit 9 EXPLORING DIVISION

finding the number in each group	162-163
subtracting to find the quotient	164-165
finding the number of groups	166-167
subtracting to find the quotient	168-169
practicing division	170-171
division on the number line	172
relating multiplication and division	173-175
using multiplication to divide	176-177
 Guess and test	178
CHECKING UP	179


Unit 10 GEOMETRY AND MEASUREMENT

similar shapes	180-181
finding area	182-183
volume	184-185
practice in length, area, and volume	186
drawing bar graphs	187
patterns using slides	188-189
line symmetry, symmetric shapes	190-193
slides, flips, and turns	194-195
positions and pairs of numbers	196-199
CHECKING UP	200
CHECKING SKILLS	201


Unit 11 NUMERATION

numbers to 9999	202-203
expanded form	204-205
regrouping	206-207
comparing and ordering numbers	208-209
fractions: part of a set	210-211
 More information needed	212
CHECKING UP	213

Unit 12 ADDITION

reviewing addition skills	214-219
four-digit sums, practice	220-223
adding amounts of money	224-227
adding three numbers, practice	228-231
 Choosing the information needed	232
CHECKING UP	233


Unit 13 SUBTRACTION

Reviewing subtraction skills	234-239
Four-digit minuends, practice	240-242
Subtracting amounts of money	243
Using addition to check subtraction	244-245
Regrouping with zeros, practice	246-249
 Finding the missing information	250
CHECKING UP	251


Unit 14 DECIMALS

Reviewing decimal tenths	252-253
Subtracting decimals	254-255
Addition and subtraction practice	256-257
Using decimals to show hundredths	258-259
Decimals and money	260-261
Metres, centimetres, and decimals	262-263
CHECKING UP	264
CHECKING SKILLS	265-267

Unit 15 MULTIPLICATION

Reviewing concepts, notation	268-269
6 and 7 as factors, practice	270-272
8 and 9 as factors, practice	273-277
10 and multiples of 10 as factors	278-279
Introduction to the algorithm	280-285
The standard algorithm	286-289
 More than one solution	290
CHECKING UP	291

Unit 16 DIVISION

Reviewing division concepts	292-293
Using multiplication to divide	294-301
Remainders	302-303
The standard algorithm, remainders	304-305
 The concluding statement	306
CHECKING UP	307
Practice with basic facts	308-311
Symbols, Table of Related Units	312
Index	313-316

The Mathematics Center

A mathematics center, like centers for other subject areas, is a place for the storage of certain specific materials and an area for the children to become involved in activities. With careful planning and involvement of the children, the mathematics center can become a stimulating environment. The children will enjoy bringing materials from home to supplement and add variety to those in the center. The mathematics center is an ideal place to display the children's work. If a thematic approach is used for teaching mathematics, the center can be adapted as a setting for each new theme.

When the children have finished their regular assignments, they may engage in extra activities and projects in the mathematics center. Activity cards, puzzles, games, and homemade as well as commercial materials will lead the children to broader understanding as well as provide opportunities for the teacher to observe and question the children, and to evaluate their progress. Consideration of the children's interaction in the mathematics center will suggest adaptations to make this strategy an important part of the learning experience.

STORAGE OF MATERIALS

Materials should be stored where children can have easy access to them. Open shelves and small tables can be used in a pleasing and practical arrangement for holding containers. Containers for materials should be both sturdy and colorful. Vinyl coverings, spray enamel, wallpaper, and fabric will increase the durability of the containers as well as increase the appeal of the mathematics center. Some ideas for suitable containers are pails (formed by cutting the top off a large plastic bottle), trays (from corrugated boxes in which canned goods are sold), baskets (in which fruit and vegetables are sold), boxes (sturdy ones such as those from small appliances), and other containers (ice cream containers, large cans, plastic tubs, foil containers).

MATERIALS

The materials used for teaching mathematics need not be expensive commercial materials; simple everyday objects can be used effectively as learning and teaching aids.

A list of the materials suggested for each unit is given in the unit overview. When a unit is almost completed, look ahead to the next unit and begin to collect and have the children help to collect the materials.

The following materials will be helpful for developing the various concepts and skills.

Number

- counters such as buttons, beans, pebbles, bingo chips
- objects for grouping, such as pipe cleaners, drinking straws, stirrers, beans in plastic bags, Unifix cubes
- models for ones, tens, hundreds, and thousands
- flash cards for basic addition, subtraction, multiplication, and division facts
- dominoes and domino cards, playing cards, dice
- shapes marked to show halves, thirds, fourths, and tenths of a whole
- set holders such as plastic tubs, egg cartons, plastic hoops, Styrofoam trays, paper or foil plates

Geometry

- a collection of three-dimensional shapes, such as balls, boxes, cores from rolls of paper, funnels
- commercial wooden or plastic solids (cubes, cones, spheres, cylinders, prisms, pyramids)
- commercial wooden or plastic plane shapes (triangles, rectangles, squares, pentagons, hexagons, octagons, circles)
- geoboards, rubber bands, geopaper from page T366
- parquetry blocks, gummed shapes for forming patterns
- pictures of symmetrical objects and shapes
- cutouts of plane shapes for showing slides, flips, and turns
- felt, plastic, or cardboard tangram pieces
- materials for constructing models of three-dimensional shapes (straws, pipe cleaners, toothpicks, plasticine, clay)
- square tiles (ceramic tiles, floor tiles)
- samples of fabric and wallpaper designs
- centimetre cubes

Measurement

- real money, play money, cutouts from pages T351 and T352
- non-standard units for measuring length (straws, paper clips, ribbons), capacity (jars, paper cups, milk cartons), mass (washers, plasticine balls)
- unmarked metre sticks, metre sticks and tapes marked in centimetres and decimetres
- rulers or straight edges, wall chart for measuring heights
- containers for comparing capacity (jars, bottles, cans, boxes)
- materials for filling containers (sand, water, rice)
- one-litre containers, other containers marked in litres (juice cans, pails) and in millilitres (soft-drink cans, tinned goods)
- objects for comparing masses (pebbles, stones, books)
- one-kilogram masses, objects whose mass is marked in kilograms (boxes of detergent, bags of sugar) and in gram (boxes of cereal, pasta, or crackers)
- balance scales, kitchen scales, step-on scales
- thermometers for measuring air and water temperature
- sample calendars and blank calendars, a *World Almanac*

There are many other teaching aids that will be useful in mathematics program, for example, D-Stix, Multibase Arithmetic Blocks. They may be acquired over a number of years, but the following aids are basic for the activities suggested in this book.

Display Board: This may be a flannel board, a magnetic board, or a bulletin board for use with cutouts of objects, numerals, and symbols in demonstrating new concepts.

Attribute Blocks: These are sets of wooden or plastic blocks that show likenesses and differences in color, shape, size, and thickness. One set usually includes 48 pieces made up of four shapes (circle, rectangle, square, triangle), three colors (red, blue, yellow), two sizes, and two thicknesses. (Some sets also include the hexagon.)

If commercial attribute blocks are not available, you may wish to make your own blocks by using the patterns on pages T355 and T356. The blocks may be made from plywood of two thicknesses, one of which is about three times as thick as the other.

Number Line: A number line on the chalkboard or display board may be permanently displayed where children can see it from their desks. Each child should have an individual number line.

Other teaching aids are described on page T348.

Timing Schedule

The following information will guide you in planning your schedule for working through *Starting Points in Mathematics 3* in one year. Depending on the abilities of the children in your class, you will find sufficient material in Book 3 for a minimum program, an average program, and an enriched program.

For this book, most lessons are developed over two pages and these are referred to as “double page” lessons in the table below. There are also several “single page” lessons, for example, the *Checking Up* lesson that appears at the end of each unit.

There are approximately 175 days in the school year. The number of lessons in Book 3 is 175. This number excludes the maintenance exercises provided after the *Checking Up* pages for units 4, 7, 10, 14, and 16. No suggestions have been made for these and other maintenance lessons because the need for these can be determined only by you for the children in your particular class.

The number of days required to complete a unit will depend on the level of the children in your class. For example, since the work in the 13 lessons of Unit 1 (basic addition and subtraction facts) likely will be review for most children, no more than eight days may be needed to complete the unit. Children who have completed the first two books of *Starting Points in Mathematics* may be able to complete Unit 2 in 14 days or fewer. If much of the work of Unit 2 is new for children, however, you may plan to spend as many as 17 to 20 days to consolidate the concepts of the unit. Other alternatives for Unit 2 include omitting certain lessons and teaching them just before they are met in context. For example, regrouping numbers in Unit 2 may be delayed until Unit 3 (addition with regrouping) and Unit 5 (subtraction with regrouping). The lessons on fractions in Unit 2 may be delayed until Unit 4 (geometry) and taught effectively at that time when manipulative work with plane shapes is involved. The lessons on time could be presented at any time during the year at your discretion.

Teachers wishing to provide a minimum program may plan to omit part or all of certain units and, depending on the children’s progress, return to some of these later in the year. In planning any schedule, it should also be kept in mind that certain topics such as measurement (Unit 6) and geometry (Units 4 and 10) require more time than others as they involve more activity with concrete objects and manipulative materials.

Unit	Number of Lessons		Lessons in Unit	Number of Days	My Schedule
	Double Page	Single Page			
1	9	4	13	8—12	
2	10	4	14	12—20	
3	8	4	12	10—14	
4	5	1	6	6—9	
5	9	2	11	11—13	
6	9	4	13	11—15	
7	7	1	8	7—9	
8	8	6	14	12—14	
9	7	4	11	9—13	
10	8	5	13	13—15	
11	5	2	7	5—8	
12	9	2	11	9—12	
13	7	4	11	9—12	
14	6	1	7	6—8	
15	9	6	15	14—16	
16	7	2	9	8—10	
Total	123	52	175	150—200	

Unit 1 Overview

Addition and Subtraction Facts

This unit reviews the concepts of addition and subtraction through situations that involve joining, separating, and comparing sets of objects. Practice is provided for basic addition and subtraction facts having sums and minuends to 18. The relationship between addition and subtraction is examined and then utilized to arrange the facts in convenient family groupings in order to facilitate learning.

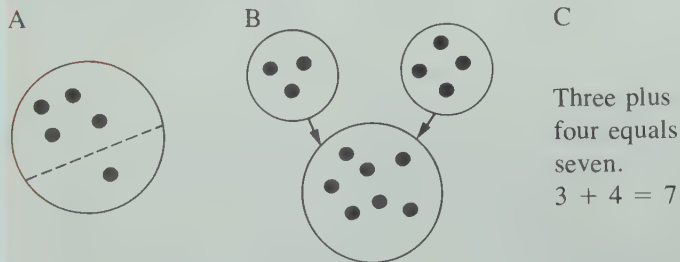
While the commutative (order) property of addition is suggested in the first lesson but not presented formally, it is expected that it will be reviewed and used to limit the number of facts that need to be learned. The associative (grouping) property of addition is explored and the generalization is drawn that addends can be arranged in any convenient order when adding more than two numbers.

Unit Outcomes

- complete basic addition and subtraction facts, sums and minuends to 18, and solve related word problems
- write a related addition or subtraction fact for a given basic addition or subtraction fact
- write the family of addition and subtraction facts for a given basic addition or subtraction fact
- write two families of addition and subtraction facts for a given pair of numbers
- use the associative (grouping) property with three addends arranged horizontally and vertically, sums to 18
- draw a picture and write either an addition or a subtraction sentence to solve a problem

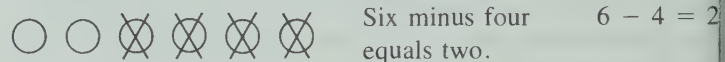
Background

The operation of joining sets forms one concept for addition of numbers. Addition is associated with the joining of two distinct sets. An understanding of the concept can develop gradually through several stages. Children usually begin at the concrete level, grouping objects into sets, and then exploring the results of partitioning sets in different ways and joining pairs of sets. Emphasis at this time is given to oral reporting of the actions. At a later stage, illustrations and semi-abstract symbols depict the actions. For example, a set of 5 can be partitioned to show 4 and 1 (A), and joining a set of 3 and a set of 4 gives a set of 7 (B). Eventually, at the abstract level, only the numerals and symbols are used for the formal language of addition (C), and emphasis can be given to mastering the basic addition facts.



The number of facts to be learned is reduced considerably because of the commutative (order) property of addition, which states that the order of adding two numbers does not affect their sum. Thus, knowing $3 + 4 = 7$, for example, helps in knowing $4 + 3 = 7$. Lesson activities in this unit suggest appropriate times for reviewing this property.

An understanding of subtraction can develop in a manner similar to that described for addition, beginning with experiences at the concrete level, progressing through a stage where illustrations and semi-abstract symbols depict the actions, and eventually reaching the abstract level at which only the numerals and symbols are used. However, there are two aspects of subtraction that need to be considered, *separation* and *comparison*. Separation is associated with the removal of objects from a set and finding how many objects are left. Children usually meet this "take-away" approach first, since it is found to be the easiest and the most common in their experiences. They can use sets of objects and remove or separate members to discover the subtraction facts. Later, concrete objects can be replaced by illustrations and these, in turn, related to the formal language and symbols of subtraction.



The comparison aspect of subtraction is associated with finding which of two sets has more (fewer) objects and how many more (fewer). At the concrete level, children may compare two sets by one-to-one matching and counting the unmatched members. This can be shown in a simple illustration at the semi-abstract level.



At the abstract level, children compare two numbers by subtracting one from the other. The result is called the *difference* of the two numbers. For example, 6 is greater than 4, and 4 is less than 6, and their difference is 2 because $6 - 4 = 2$.

This book emphasizes *basic* addition and subtraction facts. The sum of any two numbers gives an addition fact. If each of the two addends is less than 10, the sentence describes a *basic addition fact* having a sum of 18 or less; for example $5 + 4 = 9$. If either of the two addends is subtracted from the sum, the result is the other number, and the sentence describes a *basic subtraction fact*; for example, $9 - 4 = 5$, or $9 - 5 = 4$. This relationship between addition and subtraction, along with the commutative property of addition, makes it possible to organize basic number facts into sets which are sometimes called *families*. For unequal addends, there are four related addition and subtraction facts (D). For addends which are equal, there are two related facts in the family (E).

D	$5 + 4 = 9$	E	$8 + 8 = 16$
	$4 + 5 = 9$		$16 - 8 = 8$
	$9 - 4 = 5$		
	$9 - 5 = 4$		

Facts such as $15 + 4 = 19$, $25 + 4 = 29$, and $39 - 4 = 35$ are called *extensions* of basic facts (see Unit 3 Overview). In organizing basic facts into sets of related facts, they can recall them much more easily than if they learn the facts individually.

The vertical form for showing addition is reviewed as an alternative way of writing number sentences. It is important that children learn to use the vertical form, in preparation for the work in later units involving addition of two-digit and three-digit numbers.

The four basic operations (addition, subtraction, multiplication, division) are known as *binary operations* because only two numbers can be combined at one time. If there are more numbers, as in column addition, the operation is performed on one pair of numbers and the result is then combined with the next number. The order of grouping addends when there are more than two does not affect their sum. Because of this property, known as the *associative property of addition*, addition of more than two numbers can be checked by grouping different pairs of addends.

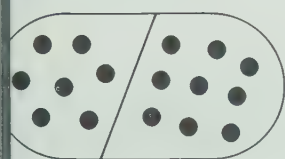
$$(3 + 4) + 5 = 7 + 5 = 12 \qquad 3 + (4 + 5) = 3 + 9 = 12$$

In this unit, children will experience addition of three one-digit numbers for sums to 18. Because of this restriction on the sum, there will be little involvement at this time with extensions of basic addition facts. Extensions of basic facts are more fully developed in Unit 3.

Teaching Strategies

It is important for the children's understanding that they draw their concepts of addition and subtraction from their experiences with concrete materials. It is recommended that each lesson begin with a demonstration using concrete materials and/or a concrete manipulative activity for the children. This can be followed by semi-abstract examples and finally abstract number sentences. Some children may benefit from the use of counters, or a device such as the number line, to help them complete number sentences.

While this unit is likely review for most children, it may be necessary to reteach the basic concepts and have children rediscover basic facts. Mastery of the facts is prerequisite and this may be achieved through drill devices and games as described in the lesson activities. The lesson activities described for pages 10 to 13, for instance, present the children with summaries to assist them in mastering basic facts. Tables similar to those on page 14 can be used for further practice with basic facts. Also grouping the facts into families greatly assists in learning the subtraction facts since each subtraction fact can be related to an addition fact.



$$\begin{array}{ll} 7 + 9 = 16 & 9 + 7 = 16 \\ 16 - 9 = 7 & 16 - 7 = 9 \end{array}$$

A table like the one shown under *Related Activities* on page T 3 can be used to summarize all the basic addition facts and to generate all the basic subtraction facts. The number board described on page T 319 can be adapted for use as an addition table for basic facts. The board can be used by children in activities that help them to master the facts. For example, numeral tags can be prepared to show sums and children can help to hang the tags. As basic facts are mastered the corresponding tags for sums may be turned with their blank sides out. Also, tags for addends may be arranged in a different order and the children may be challenged to hang the tags for sums correctly.

Note that the vocabulary list for this unit includes words for the formal language of addition and subtraction. Careful and regular use of words such as *addend*, *sum*, *minuend*, and *difference* can encourage children to use the words correctly and feel comfortable with their use.

Materials

various objects for sets
groups with one to nine objects
display board and cutouts
9 red counters and 9 blue counters for each child
demonstration number line
set of large cards showing from 0 to 9 dots

Vocabulary

addition sentence	minuend	is greater than
subtraction sentence	minus	is less than
addition table	difference	number line
subtraction table	related fact	nomograph
addends	family of facts	one dozen
plus	more than	equals
sum	fewer than	

LESSON OUTCOME

Complete addition facts for sums to 10

Materials

groups with one to nine objects or the display board and cutouts, counters, copies of page T 360

Vocabulary

addition sentence, plus, equals, addends, sum

1 ADDITION AND SUBTRACTION FACTS

Joining Sets—Sums to 10



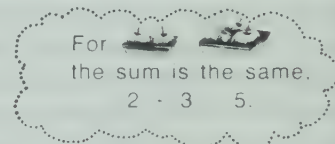
3 apples in one tray.
2 apples in another.
How many apples in all?



There are 5 apples in all

The **addition sentence** also shows that 3 plus 2 equals 5

3 and 2 are **addends**. 5 is the **sum**.



2

LESSON ACTIVITY

Before Using the Pages

- This lesson is primarily a review. To help the children recall that addition is associated with a joining action, present several joining situations.

Arrange several groups with one to nine objects on a table or use cutouts on the display board. (Since the theme of this unit is food, you might use objects or cutouts suggesting food such as apples and pears.) Indicate two groups of objects and ask how many there are in each group. Have a child join the two groups to form a new group and tell how many objects there are in all. Repeat several times. (Note that the sums are not greater than 10 for this lesson.)

Using the Pages

- Have the children name items shown in the picture on page 2. Discuss which foods they prefer and have them name other fruits and vegetables sold in stores similar to the one shown. Discuss the fact that supermarkets often sell fruits packaged in trays.
- Read through the worked example with the children. Introduce the terminology of addition and review the symbols used in writing addition facts. Emphasis is placed on the two forms, vertical and horizontal, for writing addition facts. Ask questions similar to the following and have children write the addition facts on the board.
 - "If the first tray held four apples, how many apples would there be in all?"
 - "What numbers are the addends?"
 - "What name do we give the number 6?"
 - "What is the addition sentence?"

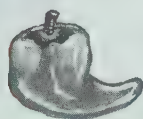
Working Together

- How many yellow bananas? **4**
- How many green bananas? **2**
- How many bananas in all? **6**
- Complete this sentence.

$$4 + 2 = \text{ } \quad \text{6}$$



- How many green peppers? **1**
- How many red peppers? **3**
- How many peppers in all? **4**
- Give an addition sentence for the picture. **$1 + 3 = 4$**



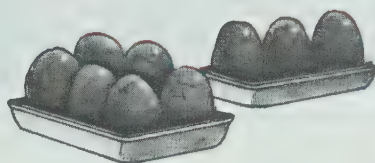
Add. *If the children write the addends in the opposite order, the number sentence is acceptable.*

- $\begin{array}{r} 1 \\ + 5 \\ \hline 6 \end{array}$
- $\begin{array}{r} 3 \\ + 4 \\ \hline 7 \end{array}$
- $\begin{array}{r} 4 \\ + 6 \\ \hline 10 \end{array}$
- $0 + 7 = 7$
- $3 + 3 = 6$
- $7 + 0 = 7$
- $2 + 4 = 6$

Exercises

Write an addition sentence for each picture.

- $4 + 3 = 7$**
- $6 + 3 = 9$**



Add.

- $7 + 1 = 8$
- $7 + 2 = 9$
- $6 + 4 = 10$
- $2 + 5 = 7$
- $8 + 2 = 10$
- $5 + 4 = 9$
- $9 + 1 = 10$
- $2 + 2 = 4$
- $\begin{array}{r} 1 \\ + 4 \\ \hline 5 \end{array}$
- $\begin{array}{r} 2 \\ + 1 \\ \hline 3 \end{array}$
- $\begin{array}{r} 3 \\ + 5 \\ \hline 8 \end{array}$
- $\begin{array}{r} 6 \\ + 1 \\ \hline 7 \end{array}$
- $\begin{array}{r} 5 \\ + 5 \\ \hline 10 \end{array}$
- $\begin{array}{r} 9 \\ + 0 \\ \hline 9 \end{array}$
- $\begin{array}{r} 0 \\ + 5 \\ \hline 5 \end{array}$
- $\begin{array}{r} 3 \\ + 7 \\ \hline 10 \end{array}$
- $\begin{array}{r} 2 \\ + 6 \\ \hline 8 \end{array}$
- $\begin{array}{r} 2 \\ + 3 \\ \hline 5 \end{array}$
- $\begin{array}{r} 6 \\ + 0 \\ \hline 6 \end{array}$
- $\begin{array}{r} 8 \\ + 1 \\ \hline 9 \end{array}$

3

RELATED ACTIVITIES

• Adapt page T 360 to provide each child with a copy of a blank addition table showing the addends 0 to 9. Have the children write the sums to 10 in the region above the broken line. The rest of the chart can be completed after basic addition facts with sums to 18 have been reviewed.

+	0	1	2	3	4	5	6	7	8	9
0										
1								8		
2										
3										
4		5								
5										
6										
7										
8										
9										

The table shows the sum for 1 and 7 as well as 4 and 1. Note that the first addend is selected from the left column and the second addend from the top row.

The "thought" presented at the lower right of the pupil's page provides you with an opportunity to discuss the fact that the order of adding two numbers does not affect the sum.

Working Together: Both the horizontal and the vertical forms for addition are presented in these exercises. Note that Ex. 1-8 provide the children with illustrations to help them find the sums, but the remaining exercises do not. Children who appear to have difficulty with these may need to use counters.

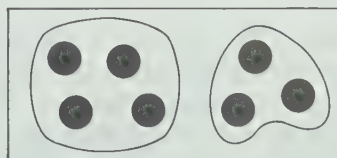
For Ex. 8 the children may write $1 + 3 = 4$ or $3 + 1 = 4$. This provides you with another opportunity to discuss the fact that the order of adding two numbers does not affect the sum. Use other examples as needed. For Ex. 12, discuss the effect of zero as an addend.

Exercises: You may wish to have the children show the two addition sentences for Ex. 1 and 2.

Assessment

Write an addition sentence for the picture.

1.



$$4 + 3 = 7$$

or

$$3 + 4 = 7$$

Add.

- $4 + 6 = 10$
- $2 + 5 = 7$
- $\begin{array}{r} 7 \\ + 2 \\ \hline 9 \end{array}$
- $\begin{array}{r} 0 \\ + 6 \\ \hline 6 \end{array}$

OBJECTIVE

Recall addition facts, sums to 10; solve related word problems

Materials

demonstration number line

Vocabulary

number line

Practice



Write an addition sentence and answer each question. *The addends in the opposite order are acceptable.*

1. 3 red plums
5 purple plums $3+5=8$
How many plums in all? 8
2. 4 loaves of white bread.
2 loaves of brown bread $4+2=6$
How many loaves in all? 6
3. 2 cartons of white milk.
3 cartons of chocolate milk $2+3=5$
How many cartons in all? 5
4. 6 cans of orange juice.
4 cans of lemonade $6+4=10$
How many cans in all? 10
5. 2 boxes of wheat flakes.
1 box of corn flakes $2+1=3$
How many boxes in all? 3
6. 5 cans of corn
4 cans of peas $5+4=9$
How many cans in all? 9
7. 8 bars of yellow soap
2 bars of white soap $8+2=10$
How many bars in all? 10
8. 6 cans of tomato soup
3 cans of chicken soup $6+3=9$
How many cans in all? 9

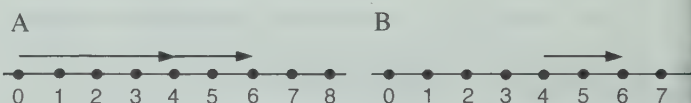
4

LESSON ACTIVITY

Before Using the Pages

- Since the number line appears in *Try This*, this would be an opportune time to review showing addition on the number line. Children who have not yet mastered the basic facts with sums to 10 will benefit from reviewing this model for addition and will be able to use the number line on page 5 (rather than counters) if necessary for the exercises on these pages.

Use the demonstration number line or draw a number line on the board. Demonstrate how to find the sum for an exercise such as $4 + 2$. You may start at 0 and move 4 units to the right and then move 2 more units to the right (A), or you may start at 4 and move 2 units to the right (B). The method described for B is shorter and children who have some familiarity with the number line may prefer this method.



Have children show several other examples of addition on the number line.

Using the Pages

- Ask the children whether they enjoy going to the supermarket or grocery store to help with the shopping. Have them suggest how they use addition when shopping.
- Discuss using addition to determine not only the cost, but also how many of each item are bought. Have the children identify familiar items in the picture. Ask how many cartons of white milk and how many cartons of chocolate milk are shown. Then ask how many cartons of milk there are in all. Ask what addition sentence tells this. Write the addition sentence and the concluding statement for the word problem on the board.

Add.

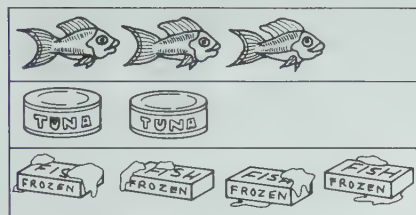
9. $9 + 0 = 9$ 10. $5 + 1 = 6$ 11. $3 + 3 = 6$ 12. $1 + 2 = 3$
 13. $0 + 5 = 5$ 14. $2 + 5 = 7$ 15. $6 + 1 = 7$ 16. $8 + 0 = 8$
 17. $6 + 2 = 8$ 18. $4 + 4 = 8$ 19. $1 + 3 = 4$ 20. $3 + 1 = 4$
 21. $\begin{array}{r} 4 \\ +5 \\ \hline 9 \end{array}$ 22. $\begin{array}{r} 2 \\ +8 \\ \hline 10 \end{array}$ 23. $\begin{array}{r} 4 \\ +0 \\ \hline 4 \end{array}$ 24. $\begin{array}{r} 3 \\ +7 \\ \hline 10 \end{array}$ 25. $\begin{array}{r} 9 \\ +1 \\ \hline 10 \end{array}$ 26. $\begin{array}{r} 7 \\ +2 \\ \hline 9 \end{array}$
 27. $\begin{array}{r} 1 \\ +6 \\ \hline 7 \end{array}$ 28. $\begin{array}{r} 4 \\ +3 \\ \hline 7 \end{array}$ 29. $\begin{array}{r} 0 \\ +7 \\ \hline 7 \end{array}$ 30. $\begin{array}{r} 1 \\ +9 \\ \hline 10 \end{array}$ 31. $\begin{array}{r} 2 \\ +2 \\ \hline 4 \end{array}$ 32. $\begin{array}{r} 5 \\ +5 \\ \hline 10 \end{array}$

Write an addition sentence to show the sum of each pair.

The addends in the opposite order are acceptable.

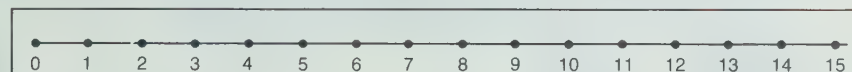
33. 4 and 6 $4+6=10$ 34. 8 and 1 $8+1=9$ 35. 7 and 0 $7+0=7$ 36. 1 and 5 $1+5=6$
 37. 0 and 9 $0+9=9$ 38. 5 and 2 $5+2=7$ 39. 2 and 7 $2+7=9$ 40. 1 and 8 $1+8=9$
 41. 2 and 4 $2+4=6$ 42. 3 and 2 $3+2=5$ 43. 5 and 3 $5+3=8$ 44. 6 and 0 $6+0=6$

Mr. Kirby bought these items.



Write an addition sentence and answer each question.

45. How many cans or boxes did he buy? $2+4=6$
 46. How many items did he buy that were not frozen? $3+2=5$



Follow each pattern and write the next three numbers.

1. 1, 3, 5, 7, 9, 11, 13
 2. 0, 2, 4, 6, 8, 10, 12
 3. 0, 3, 6, 9, 12, 15, 18
 4. 7, 6, 5, 4, 3, 2, 1
 5. 12, 10, 8, 6, 4, 2, 0
 6. 18, 15, 12, 9, 6, 3, 0
 7. 2, 5, 8, 11, 14, 17, 20
 8. 1, 4, 7, 10, 13, 16, 19
 9. Start a number pattern of your own. Write the first four numbers. Have a friend write the next three. Answers will vary.

try this

5

RELATED ACTIVITIES

- Children may enjoy practicing addition facts for sums to 10 by playing the game "Better's Choice" in groups of two to four players.

Materials: a game board and a spinner as shown; addition fact cards for sums to 10.

Better's Choice	
0	1
2	3
4	5
6	7
8	9
10	



4 + 3

Rules:

- The addition fact cards are shuffled and dealt equally among the players.
- Each player places one or more cards on the game board to indicate her/his bet by matching the addition fact on the card with the correct sum on the game board.
- After all bets are placed, one player spins the spinner.
- The player whose card is on the winning number claims all the cards on the game board. If two or more players have an addition fact card on the winning number, the cards are shared.
- At the end of a time limit, the player with the most cards is the winner.

Exercises: Ensure that the children understand the instructions.

For the word problems, help the children who have difficulty reading the words.

For Ex. 33-44 there are two possible sentences to show the sum of each pair of numbers. Review the order (commutative) property of addition.

This: The number line is provided here as an aid for discovering patterns. (Note that the patterns for Ex. 4-6 show a right to left movement on the number line, and thus, relate to the operation of subtraction.)

LESSON OUTCOME

Complete subtraction facts for separating situations, minuends to 10

Materials

ten objects or the display board and ten cutouts, counters (optional)

Vocabulary

subtraction sentence, difference, minus, minuend (optional)

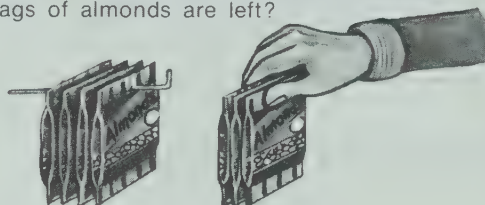
Background

Subtraction can involve the idea of separation (take away) which is reviewed here, or the idea of comparison which is reviewed on page 8. The expression "take away" describes an action with objects. The word "subtract" describes the operation with numbers.

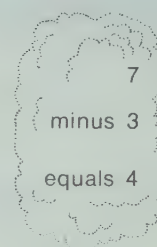
Separating Sets – Minuends to 10



7 bags of almonds.
Buy 3 bags. How many
bags of almonds are left?



$$\begin{array}{r} 7 \\ - 3 \\ \hline 4 \end{array}$$



There are 4 bags left.

The subtraction sentence $7 - 3 = 4$
also shows that 7 minus 3 equals 4.

4 is the difference of 7 and 3.

6

LESSON ACTIVITY

Before Using the Pages

- To remind the children that subtraction is sometimes associated with separation, present several situations of removing objects from a group.

Arrange a group with one to ten objects on a table or use cutouts on the display board. (Objects similar to those suggested for page 2 are suitable here.) Ask how many objects are in the group. Name a number and have a child remove this number of objects from the group. Ask how many are left. Repeat several times.

To involve zero in subtraction, include situations of removing all the objects from a group and others of removing no objects.

- Ask the children if they know the name of the operation related to "taking away". Elicit the word *subtraction* from them. Have them suggest ways of using subtraction when shopping.

Using the Pages

- The worked example introduces the terminology and symbols for subtraction. Note that the symbol $-$ is read "minus" not "take away", since subtraction does not always involve separation (see *Background*). Read the worked example with the children. Point out that, as for addition facts, there is a horizontal form and a vertical form for writing subtraction facts. Ask questions similar to the following and have children write the subtraction facts on the board.
"If you took away two bags of almonds, how many bags of almonds would be left?"
"What is the subtraction sentence?"
"What is the difference?"

Working Together

- 1. How many boxes in all? 5
- 2. 1 box is sold.
How many are left? 4
- 3. Complete this sentence.
 $5 - 1 = 4$
- 4. How many boxes in all? 10
- 5. 6 boxes are sold.
How many are left? 4
- 6. Give a subtraction sentence for the picture. $10 - 6 = 4$



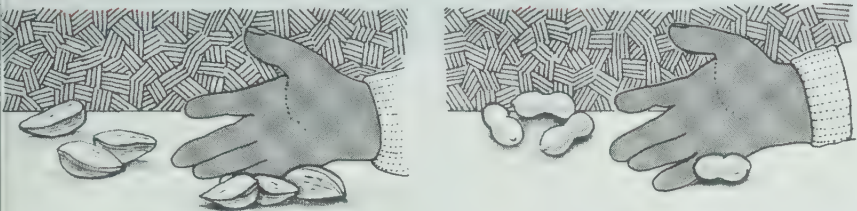
Subtract.

- 7. $\begin{array}{r} 5 \\ -3 \\ \hline 2 \end{array}$
- 8. $\begin{array}{r} 8 \\ -8 \\ \hline 0 \end{array}$
- 9. $\begin{array}{r} 10 \\ -1 \\ \hline 9 \end{array}$
- 10. $5 - 4 = 1$
- 11. $6 - 0 = 6$

Exercises

Write a subtraction sentence for each picture.

- 1. $6 - 3 = 3$
- 2. $4 - 1 = 3$



Subtract.

- 3. $\begin{array}{r} 9 - 4 \\ \hline 5 \end{array}$
- 4. $\begin{array}{r} 8 - 1 \\ \hline 7 \end{array}$
- 5. $\begin{array}{r} 4 - 4 \\ \hline 0 \end{array}$
- 6. $\begin{array}{r} 10 - 3 \\ \hline 7 \end{array}$
- 7. $\begin{array}{r} 5 - 0 \\ \hline 5 \end{array}$
- 8. $\begin{array}{r} 6 - 5 \\ \hline 1 \end{array}$
- 9. $\begin{array}{r} 10 - 9 \\ \hline 1 \end{array}$
- 10. $\begin{array}{r} 9 - 2 \\ \hline 7 \end{array}$
- 11. $\begin{array}{r} 8 \\ -3 \\ \hline 5 \end{array}$
- 12. $\begin{array}{r} 5 \\ -5 \\ \hline 0 \end{array}$
- 13. $\begin{array}{r} 8 \\ -4 \\ \hline 4 \end{array}$
- 14. $\begin{array}{r} 9 \\ -0 \\ \hline 9 \end{array}$
- 15. $\begin{array}{r} 3 \\ -2 \\ \hline 1 \end{array}$
- 16. $\begin{array}{r} 6 \\ -1 \\ \hline 5 \end{array}$
- 17. $\begin{array}{r} 7 \\ -6 \\ \hline 1 \end{array}$
- 18. $\begin{array}{r} 8 \\ -6 \\ \hline 2 \end{array}$
- 19. $\begin{array}{r} 10 \\ -2 \\ \hline 8 \end{array}$
- 20. $\begin{array}{r} 10 \\ -4 \\ \hline 6 \end{array}$
- 21. $\begin{array}{r} 10 \\ -5 \\ \hline 5 \end{array}$
- 22. $\begin{array}{r} 10 \\ -7 \\ \hline 3 \end{array}$

RELATED ACTIVITIES

You may wish to have the children organize the subtraction facts having minuends to 10 in a chart similar to the following.

0	1	9
$10 - 10$	$10 - 9$	$10 - 1$
$9 - 9$	$9 - 8$	$9 - 0$
$8 - 8$	$8 - 7$	
$7 - 7$		

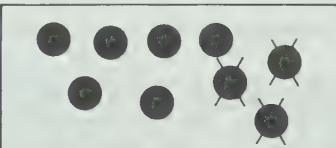
Working Together: The stages developed in these exercises are:

- (1) completing a subtraction sentence for a given illustration;
 - (2) writing a subtraction sentence for a given illustration;
 - (3) completing subtraction facts without an illustration.
- Use similar exercises at each stage as needed.

Exercises: It may be necessary to provide counters for children who do not have immediate recall of the subtraction facts.

Assessment

Write a subtraction sentence for the picture.

1. 

$9 - 3 = 6$

Subtract.

- 2. $\begin{array}{r} 10 - 9 \\ \hline 1 \end{array}$
- 3. $\begin{array}{r} 7 - 0 \\ \hline 7 \end{array}$
- 4. $\begin{array}{r} 9 \\ -5 \\ \hline 4 \end{array}$
- 5. $\begin{array}{r} 8 \\ -3 \\ \hline 5 \end{array}$

LESSON OUTCOME

Complete subtraction facts for comparison situations, minuends to 10; solve related word problems

Materials

objects in the classroom

Vocabulary

more than, fewer than

Background

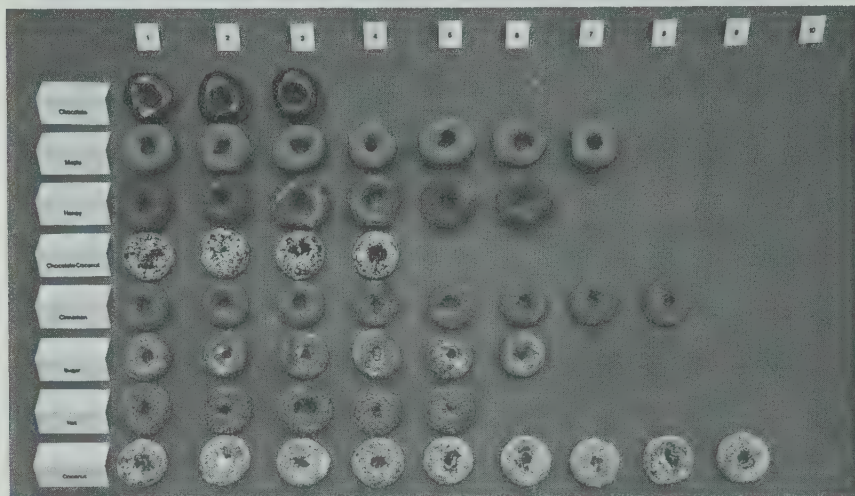
Subtraction can be associated with the idea of comparison. When comparing two sets of objects, the questions involved are which set has more (or fewer) and how many more (or fewer). With objects, the answer is found by matching the members of the two sets one to one. With numbers, the answer is found by subtraction.

Comparing Sets – Minuends to 10

The bakery has eight kinds of doughnuts for sale.

How many more
maple doughnuts than
chocolate doughnuts are there?

How many fewer
chocolate doughnuts than
maple doughnuts are there?



There are 7 maple doughnuts.

There are 3 chocolate doughnuts.

$$7 - 3 = 4$$

There are 4 more maple doughnuts
than chocolate doughnuts.

There are 4 fewer chocolate
doughnuts than maple doughnuts.

Working Together

In the picture above,

1. how many cinnamon doughnuts? 8
2. how many nut doughnuts? 5
3. Give a subtraction sentence to show how many more cinnamon doughnuts there are than nut doughnuts.
4. Give a subtraction sentence to show how many fewer nut doughnuts there are than cinnamon doughnuts.

$$8 - 5 = 3$$

$$8 - 5 = 3$$

8

LESSON ACTIVITY

Before Using the Pages

- Have the children consider comparison situations similar to the following.

“Are there more books on my desk or on Ed’s desk? How many more?”

“Which name is spelled using fewer letters, ‘Tim’ or ‘Mary’? How many fewer?”

Observe how the children find the answers. Depending on their level of thinking, they may use one-to-one matching of objects, they may draw a diagram and then use one-to-one matching, or they may count and use subtraction. After each example, suggest that subtraction can be used to find how many more or how many fewer.

Using the Pages

- Numbers for comparison situations are presented in the form of a bar graph to facilitate seeing which sets have more and which have fewer. Also, it enables children to use one-to-one matching to find or verify the answer for a subtraction exercise, if necessary.

Discuss the kinds of doughnuts shown in the picture and help the children to identify the names on the cards. Ask how many different kinds there are and then read the two worked examples. One example asks how many more maple than the other asks how many fewer. Point out that the same subtraction sentence is used to find the answer for each.

Exercises

Write a subtraction sentence and answer each question about the doughnuts.

1. How many more coconut doughnuts than 9-4=5 chocolate coconut doughnuts? 5
2. How many fewer chocolate doughnuts than 6-3=3 sugar doughnuts? 3
3. How many more cinnamon doughnuts than 8-6=2 sugar doughnuts? 2
4. How many fewer chocolate doughnuts than 8-3=5 cinnamon doughnuts? 5

Subtract.

- | | | | |
|------------|--------------|-------------|-------------|
| 5. $3-2=1$ | 6. $7-5=2$ | 7. $6-4=2$ | 8. $10-8=2$ |
| 9. $7-2=5$ | 10. $10-4=6$ | 11. $9-7=2$ | 12. $8-0=8$ |
-
- | | | | | | |
|--|---|--|---|--|--|
| 13. $\begin{array}{r} 4 \\ -0 \\ \hline 4 \end{array}$ | 14. $\begin{array}{r} 5 \\ -3 \\ \hline 2 \end{array}$ | 15. $\begin{array}{r} 5 \\ -2 \\ \hline 3 \end{array}$ | 16. $\begin{array}{r} 10 \\ -2 \\ \hline 8 \end{array}$ | 17. $\begin{array}{r} 9 \\ -3 \\ \hline 6 \end{array}$ | 18. $\begin{array}{r} 8 \\ -4 \\ \hline 4 \end{array}$ |
| 19. $\begin{array}{r} 1 \\ -1 \\ \hline 0 \end{array}$ | 20. $\begin{array}{r} 10 \\ -6 \\ \hline 4 \end{array}$ | 21. $\begin{array}{r} 6 \\ -5 \\ \hline 1 \end{array}$ | 22. $\begin{array}{r} 9 \\ -8 \\ \hline 1 \end{array}$ | 23. $\begin{array}{r} 7 \\ -1 \\ \hline 6 \end{array}$ | 24. $\begin{array}{r} 3 \\ -3 \\ \hline 0 \end{array}$ |

Write a subtraction sentence to show the difference for each pair.

25. 5 and 2 $5-2=3$ 26. 8 and 5 $8-5=3$ 27. 3 and 0 $3-0=3$ 28. 10 and 1 $10-1=9$
 29. 6 and 6 $6-6=0$ 30. 5 and 1 $5-1=4$ 31. 10 and 4 $10-4=6$ 32. 4 and 3 $4-3=1$

Write a subtraction sentence and answer each question.

33. Rebecca bought 5 honey doughnuts and 9 coconut doughnuts. How many fewer 9-5=4 honey doughnuts did she buy? 4
34. Jill bought 2 doughnuts for herself and 6 for Bonnie. How many fewer did Jill 6-2=4 buy for herself? 4
35. 7 maple doughnuts. Stuart bought 4 of them. How many 7-4=3 maple doughnuts were left? 3
36. Stuart ate 1 of his 4 doughnuts. How many doughnuts 4-1=3 did Stuart have left? 3
37. Dale bought 9 doughnuts. Mike bought 6 doughnuts. How many 9-6=3 more doughnuts did Dale buy? 3
38. Shelly bought 10 doughnuts. She gave away 7. How many 10-7=3 doughnuts did she have left? 3

9

RELATED ACTIVITIES

- The game "Bettor's Choice" described on page T5 can be adapted for practicing subtraction facts. Have the children use a set of subtraction fact cards for minuends to 10 instead of, or as well as, the addition fact cards.

Working Together: These exercises relate subtraction to a comparison situation. Point out that one situation is considered from two points of view. The first asks how many more and the second asks how many fewer, but the same subtraction sentence is used to find the answer for each.

For more practice, have the children name the kind of doughnut in the graph they like the best and the kind they like the least. Ask if there are more (fewer) of the kind they like best or the kind they like least. Have them write a subtraction sentence to show how many more (fewer).

Exercises: Review the instructions for each set of exercises and, if necessary, work through one from each set with the children. The word problems in Ex. 35, 36, and 38 involve separating actions.

Assessment

Write a subtraction sentence to show the difference for each pair.

1. 9 and 5 $9-5=4$ 2. 6 and 0 $6-0=6$ 3. 2 and 2 $2-2=0$

Write a subtraction sentence and answer the question.

4. 10 plain doughnuts. 3 iced doughnuts. How many more plain doughnuts than iced doughnuts? $10-3=7$
7
5. 4 honey doughnuts. 7 jelly doughnuts. How many fewer honey doughnuts than jelly doughnuts? $7-4=3$
3

LESSON OUTCOME

Complete basic addition facts for sums to 18

Materials

9 red counters and 9 blue counters for each child

Prerequisite Skills

Write the expanded form for the numbers 11 to 18

Vocabulary

is greater than is less than

Checking Prerequisite Skills

Complete each of the following.

1. $11 = 10 + \underline{1}$
2. $17 = 10 + \underline{7}$
3. $15 = \underline{10} + 5$
4. $13 = \underline{10} + 3$

Addition, Sums to 18

Kerry took 6 empty ginger ale bottles and 7 empty root beer bottles back to the store.
How many bottles did he take back in all?



Write the addition sentence

$$6 + 7 = 13$$

Kerry returned 13 bottles.

Addition sentences with addends in the opposite order are acceptable.

Working Together

1. How many blue bottles? 8
2. How many red bottles? 9
3. Give an addition sentence to show how many bottles in all.
 $8 + 9 = 17$
4. How many tall bottles? 4
5. How many short bottles? 9
6. Give an addition sentence to show how many bottles in all.
 $4 + 9 = 13$



Use the words "is greater than", "is less than", or "is equal to" to make true sentences.

7. $5 + 6 \begin{matrix} \text{is less than} \\ \odot \end{matrix} 3 + 9$

10. $5 + 7 \begin{matrix} \text{is equal to} \\ \odot \end{matrix} 6 + 6$

13. $9 + 1 \begin{matrix} \text{is equal to} \\ \odot \end{matrix} 8 + 2$

10 is equal to

8. $8 + 7 \begin{matrix} \text{is greater than} \\ \odot \end{matrix} 9 + 4$

11. $7 + 9 \begin{matrix} \text{is greater than} \\ \odot \end{matrix} 9 + 7$

14. $9 + 6 \begin{matrix} \text{is equal to} \\ \odot \end{matrix} 6 + 9$

is equal to

9. $8 + 8 \begin{matrix} \text{is greater than} \\ \odot \end{matrix} 5 + 9$

12. $3 + 8 \begin{matrix} \text{is equal to} \\ \odot \end{matrix} 8 + 9$

15. $4 + 8 \begin{matrix} \text{is equal to} \\ \odot \end{matrix} 8 + 4$

is less than

LESSON ACTIVITY

Before Using the Pages

- Although the work of this lesson is review, it may be necessary for some children to rediscover some of the basic facts.

Provide each child with nine red counters and nine blue counters. Instruct the children to take the nine red counters and as many blue counters as they wish to make one group. Ask each child in turn to give an addition fact describing her/his example. Write the facts on the board in a table similar to the following.

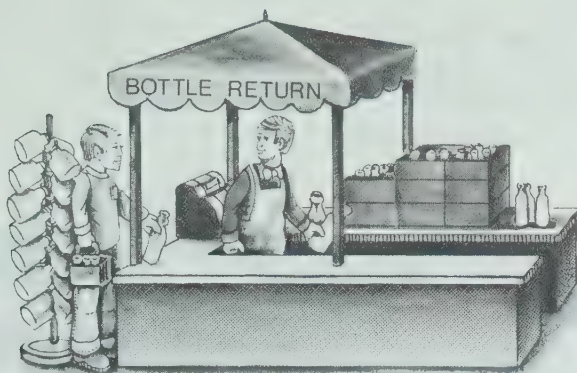
11	12	13	16	17	18
$9 + 2$	$9 + 3$	$9 + 4$	$9 + 7$	$9 + 8$	$9 + 9$

If some facts are not suggested at first, have children name the missing facts and write them in the table. Then have the children take eight red counters and as many blue counters as they wish and repeat the procedure.

- After several examples, encourage the children to complete the table without the use of their counters by continuing the pattern observed in each of the columns. The completed table presents the children with a summary to assist them in mastering the basic facts.

Using the Pages

- The example enables the children to verify the sum of six and seven by counting the bottles. If you wish, have the children cover some of the bottles from one or both groups to depict an illustration for a new problem. Then have them state the corresponding addition sentence.

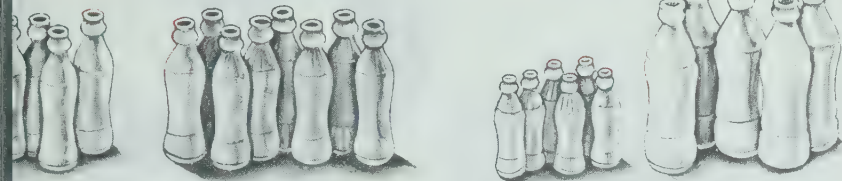


Exercises

Write an addition sentence for each picture.

1. $4 + 8 = 12$

2. $6 + 5 = 11$



3. d.

4. $5 + 9 = 14$

5. $9 + 3 = 12$

6. $1 + 9 = 10$

7. $3 + 6 = 9$

8. $9 + 0 = 9$

9. $8 + 4 = 12$

10. $5 + 7 = 12$

11. $8 + 5 = 13$

12. $8 + 6 = 14$

13. $7 + 8 = 15$

14. $6 + 5 = 11$

15. $3 + 8 = 11$

16. $9 + 5 = 14$

17. $7 + 4 = 11$

18. $9 + 6 = 15$

19. $7 + 3 = 10$

20. $5 + 8 = 13$

21. $6 + 8 = 14$

22. $4 + 6 = 10$

23. $7 + 9 = 16$

Write "is greater than", "is less than",

"is equal to" to make true sentences.

24. $2 + 9 \text{ } \text{ } 7 + 5$

25. $7 + 6 \text{ } \text{ } 7 + 7$

26. $4 + 9 \text{ } \text{ } 9 + 2$

27. $4 + 7 \text{ } \text{ } 8 + 3$

28. $7 + 9 \text{ } \text{ } 8 + 8$

29. $9 + 9 \text{ } \text{ } 9 + 8$

30. $4 + 6 \text{ } \text{ } 6 + 4$

31. $5 + 8 \text{ } \text{ } 9 + 5$

32. $8 + 7 \text{ } \text{ } 7 + 8$

is equal to
is equal to
is less than

is less than
is equal to
is less than

is equal to
is greater than
11

Working Together: The exercises lead the children through the steps of writing an addition sentence for a given illustration, writing an addition sentence without the aid of an illustration, and applying basic addition facts to compare two numbers. For Ex. 7-15, you may suggest that the children show the sum beneath each addition phrase to make it easier to determine which phrase to use.

$5 + 6 \text{ } \text{ } 6 + 6$
11 12

You may wish to introduce the symbols, $>$, is greater than, $<$, is less than, and $=$, is equal to, at this time.

Exercises: Children may suggest two sentences for each of Ex. 1 and 2. Children who do not have immediate recall of the facts can refer to the table developed for the first activity in *Before Using the Pages*.

Assessment

Add.

1. $7 + 5 = 12$

2. $9 + 8 = 17$

3. $8 + 5 = 13$

4. $6 + 9 = 15$

Write "is greater than", "is less than", or "is equal to" to make true sentences.

5. $5 + 6 \text{ } \text{ } 9 + 2$

is equal to

6. $5 + 9 \text{ } \text{ } 7 + 8$

is less than

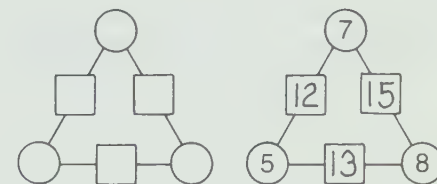
RELATED ACTIVITIES

- Have the children complete the addition table suggested in the *Related Activities* on page T 3 for the basic addition facts for sums to 18.
- The children may enjoy completing addition squares similar to the following by adding horizontally and vertically.

6	1	7
3	5	8
9	6	15

4	4	
3	5	

- Make copies of the following diagram. Show one-digit numbers as addends in the circles. Have children show the sums in the squares.



LESSON OUTCOME

Complete basic subtraction facts for minuends to 18

Materials

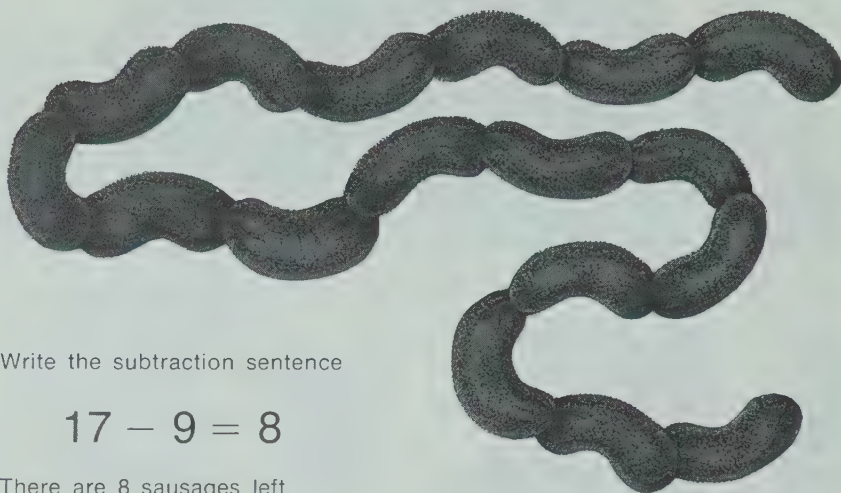
18 counters for each child

Vocabulary

one dozen

Subtraction, Minuends to 18

17 sausages linked together.
Lisa buys 9 of them.
How many sausages are left?



Write the subtraction sentence

$$17 - 9 = 8$$

There are 8 sausages left.

Working Together

Give a subtraction sentence and answer each question.

- The butcher cut 11 steaks.
Mario bought 3 steaks. $11 - 3 = 8$
How many steaks are left? **8**
- Debbie bought 12 hot dogs and
8 hot-dog rolls. How many more $12 - 8 = 4$
hot dogs than rolls did she buy? **4**

- Which are names for 9?

$$15 - 6$$

$$18 - 9$$

$$17 - 9$$

$$16 - 8$$

$$11 - 3$$

- Which are names for 6?

$$12 - 5$$

$$13 - 5$$

$$16 - 9$$

$$12 - 6$$

$$14 - 8$$

Subtract.

$$\begin{array}{r} 12 \\ - 3 \\ \hline 9 \end{array}$$

$$\begin{array}{r} 13 \\ - 9 \\ \hline 4 \end{array}$$

$$7. \quad 14 - 7 = 7$$

$$8. \quad 17 - 8 = 9$$

12

LESSON ACTIVITY

Before Using the Pages

- The following activity is suggested for children who need help in rediscovering basic subtraction facts for minuends to 18. Other children will probably be able to begin the exercises on the pages without preliminary discussion.

Have each child choose any number of counters from 11 to 18. Instruct the children to remove 9 of the counters. Ask each child in turn to name the subtraction fact describing her/his example. Write the facts on the board in a table similar to the following.

9	8	7	4	3	2
18 - 9	17 - 9	16 - 9	13 - 9	12 - 9	11 - 9

Have children name missing facts not suggested the time. Have each child choose any number of counters 11 to 17. Instruct them to remove 8 of their counters. Write the facts in the second row of the table. Continue the procedure to complete part of the table.

Then after several examples, encourage the children to continue the pattern for each column to complete the table without using counters. The completed table presents a summary of the basic subtraction facts for minuends to 18.

Using the Pages

- Discuss the store illustrated on page 13. Lead the children to suggest that each time the butcher removes a piece of meat from the display counter there are fewer left. Relate this to subtraction.

Exercises

1. Which are names for 5?
2. Which are names for 7?
3. Which are names for 8?

11 - 6

12 - 4

12 - 7

14 - 7

16 - 9

13 - 7

16 - 7

14 - 6

15 - 7

Subtract.

4. 11 - 5 6
5. 12 - 8 4
6. 15 - 8 7
7. 11 - 9 2
8. 12 - 3 9
9. 13 - 9 4
10. 11 - 7 4
11. 16 - 7 9
12. $\begin{array}{r} 12 \\ - 9 \\ \hline 3 \end{array}$
13. $\begin{array}{r} 14 \\ - 5 \\ \hline 9 \end{array}$
14. $\begin{array}{r} 11 \\ - 2 \\ \hline 9 \end{array}$
15. $\begin{array}{r} 13 \\ - 8 \\ \hline 5 \end{array}$
16. $\begin{array}{r} 12 \\ - 6 \\ \hline 6 \end{array}$
17. $\begin{array}{r} 13 \\ - 4 \\ \hline 9 \end{array}$
18. $\begin{array}{r} 11 \\ - 8 \\ \hline 3 \end{array}$
19. $\begin{array}{r} 12 \\ - 4 \\ \hline 8 \end{array}$
20. $\begin{array}{r} 15 \\ - 9 \\ \hline 6 \end{array}$
21. $\begin{array}{r} 11 \\ - 4 \\ \hline 7 \end{array}$
22. $\begin{array}{r} 13 \\ - 6 \\ \hline 7 \end{array}$
23. $\begin{array}{r} 14 \\ - 9 \\ \hline 5 \end{array}$

Write a subtraction sentence and answer each question.

24. 13 packages of bacon.
Martha buys 4 packages. $13 - 4 = 9$
How many are left? 9
25. 9 slices of salami.
Herb wants 16 slices.
How many more slices $16 - 9 = 7$
must the butcher cut? 7
26. 18 lamb chops. 9 pork chops.
How many more lamb chops $18 - 9 = 9$
than pork chops? 9
27. 14 chicken legs.
8 chicken wings.
How many fewer $14 - 8 = 6$
wings than legs? 6
28. One dozen eggs.
Gary breaks 3 eggs. $12 - 3 = 9$
How many eggs are not broken? 9



13

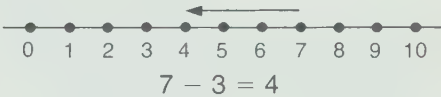
RELATED ACTIVITIES

- Children may enjoy completing subtraction squares similar to the following by subtracting horizontally and vertically.

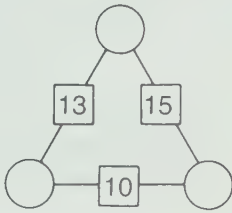
15	7	8
8	5	3
7	2	5

17	9	
8	4	

- Have the children write subtraction sentences for facts illustrated on the number line.



- Reverse the procedure given on page T 11 by showing sums for pairs of one-digit addends in the squares.



ad the worked example. Have a child explain how the illustration of the sausages can be used to verify that “seventeen minus nine equals eight”. Remind the children that “seventeen minus nine” is another name for “eight”. You may wish to refer to the table in *Before Using the Pages* to have children note the different names for the number eight.

king Together: The word problems provide examples of the two ideas of subtraction — taking away and comparing. Children would benefit from working with models or drawing simple pictures to represent these ideas.

cises: For Ex. 24-28 instruct the children to write a number sentence and a word sentence containing the answer as shown on page 12 regarding the sausages. Ex. 28 is starred since the children must know what is meant by one *dozen* before they can write the subtraction sentence.

Assessment

Subtract.

1. $\begin{array}{r} 14 \\ - 5 \\ \hline 9 \end{array}$
2. $\begin{array}{r} 13 \\ - 6 \\ \hline 7 \end{array}$
3. 15 - 8 7
4. 17 - 9 8

Which are names for 4?

5. 12 - 8 Yes
6. 11 - 6 No
7. 15 - 9 No
8. 11 - 7 Yes

Write a subtraction sentence and answer the question.

9. 12 wieners. $12 - 9 = 3$
9 meat patties. 3
How many fewer meat
patties than wieners?

OBJECTIVE

Recall basic addition and subtraction facts

Vocabulary

addition table, subtraction table, nomograph

Practice

Rosa completed this table for the rule "Add 8".

+	8
3	11... $3 + 8 = 11$
6	14
4	12
8	16
9	17... $9 + 8 = 17$
5	13
7	15

Karl completed this table for the rule "Subtract 9".

-	9
13	4
16	7
12	3
15	6
17	8
11	2
18	9
14	5

This is Ashley's addition table.

+	7	8	9
7	14	15	16
8	15	16	17
9	16	17	18

Exercises

Copy and complete each table.

1.

+	6
7	13
9	15
5	11
8	14
6	12

2.

-	8
11	3
15	7
16	8
12	4
17	9
14	6
13	5

3.

+	9
2	11
5	14
8	17
3	12
4	13
9	18
7	16
6	15

4.

-	7
15	8
12	5
16	9
11	4
14	7
13	6

5.

+	4	5	6
7	11	12	13
8	12	13	14
9	13	14	15

6.

-	6	5	4
9	3	4	5
11	5	6	7
13	7	8	9

7.

+	7	9	4
9	16	18	13
6	13	15	10
8	15	17	12

14

LESSON ACTIVITY

Using the Pages

- Discuss the addition and subtraction tables at the top of page 14. Encourage the children to question any aspect of the tables they do not understand. If necessary, copy one of the tables on the board without the answers and have children close their books. Have children write the answer for an addition or a subtraction fact in the table. Compare the answers in the table on the board with the answers in the book.
- For addition or subtraction tables similar to Ashley's, remind the children that the first number for an addition or a subtraction fact is selected from the left column, and the second number is selected from the top row.

Exercises: You may wish to provide the children with copies of the outlines on page T367 to facilitate the copying of the exercises to form tables. Encourage the children to work quickly and accurately.

Try This: Three number lines are presented in a spiral arrangement to form a *nomograph*, a device used to addition and subtraction. (The straight edge used to the points should not be numbered. A transparent straight edge is probably best since it would cover none of the numerals.) The children will probably enjoy experimenting with the nomograph to find the different sums. The device is excellent for illustrating the order property of addition. For example, two lines can be drawn to show the sum of 3 and 4. For subtraction, the children will probably discover that the minuend is shown on the center line and the number to be subtracted is shown on one of the outer lines. The difference appears on the other outer line.

RELATED ACTIVITIES

• Some children may be interested in preparing addition or subtraction tables for other children to complete.

• Children could play the game "A Number to Go" in groups of four players.

Materials: four sets of cards for the numbers from 0 to 10.

Rules:

1. Deal ten cards to each player.
2. The first player displays one of her/his cards face up, decides on a number, and states, "I want a number to go with my (7) to make (16)."
3. A player with a card for (9) answers, "Here is a (9) to go with your (7) to make (16)." That player scores one point and displays a card to begin a new round.
4. If no player has a card to satisfy the request, the player takes back the card and the next player begins a new round.
5. When one player has no cards left, the player with the most points is the winner.

• Adapt the preceding game for subtraction by using two sets of cards for the numbers from 0 to 18.

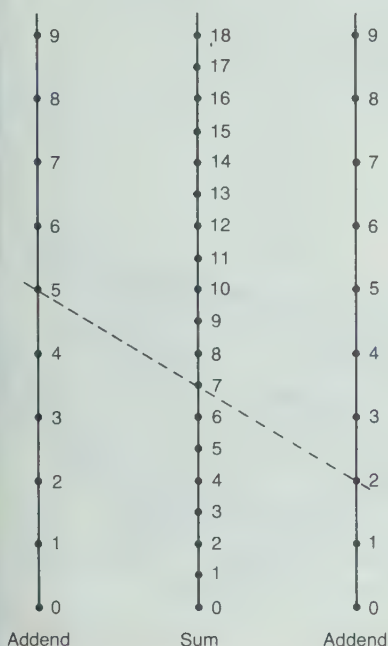
Add or subtract.

- | | | | |
|------------------|------------------|------------------|------------------|
| 8. $5 + 8 = 13$ | 9. $4 + 7 = 11$ | 10. $15 - 9 = 6$ | 11. $7 + 7 = 14$ |
| 12. $11 - 3 = 8$ | 13. $14 - 5 = 9$ | 14. $7 + 8 = 15$ | 15. $17 - 9 = 8$ |
-
- | | | | | | |
|--|--|--|--|--|--|
| 16. $\begin{array}{r} 8 \\ + 8 \\ \hline 16 \end{array}$ | 17. $\begin{array}{r} 18 \\ - 9 \\ \hline 9 \end{array}$ | 18. $\begin{array}{r} 8 \\ + 6 \\ \hline 14 \end{array}$ | 19. $\begin{array}{r} 7 \\ + 9 \\ \hline 16 \end{array}$ | 20. $\begin{array}{r} 11 \\ - 2 \\ \hline 9 \end{array}$ | 21. $\begin{array}{r} 12 \\ - 9 \\ \hline 3 \end{array}$ |
| 22. $\begin{array}{r} 14 \\ - 6 \\ \hline 8 \end{array}$ | 23. $\begin{array}{r} 4 \\ + 8 \\ \hline 12 \end{array}$ | 24. $\begin{array}{r} 12 \\ - 5 \\ \hline 7 \end{array}$ | 25. $\begin{array}{r} 9 \\ + 5 \\ \hline 14 \end{array}$ | 26. $\begin{array}{r} 2 \\ + 9 \\ \hline 11 \end{array}$ | 27. $\begin{array}{r} 11 \\ - 9 \\ \hline 2 \end{array}$ |

Write "is greater than", "is less than", or "is equal to" to make true sentences.

- | | | |
|--|---|---|
| 28. $8 + 3 \bigcirc 6 + 7$
<i>is less than</i> | 29. $6 + 5 \bigcirc 12 - 3$
<i>is greater than</i> | 30. $13 - 8 \bigcirc 12 - 6$
<i>is less than</i> |
| 31. $15 - 6 \bigcirc 17 - 8$
<i>is equal to</i> | 32. $15 - 8 \bigcirc 12 - 4$
<i>is less than</i> | 33. $16 - 7 \bigcirc 2 + 6$
<i>is greater than</i> |

NOMOGRAPH



The line on the nomograph shows this addition fact.

$$5 + 2 = 7$$

Use a straight edge on the nomograph to find each sum.

- | | |
|-----------------|-----------------|
| 1. $1 + 6 = 7$ | 2. $4 + 7 = 11$ |
| 3. $1 + 9 = 10$ | 4. $9 + 7 = 16$ |
| 5. $7 + 6 = 13$ | 6. $6 + 6 = 12$ |
| 7. $4 + 9 = 13$ | 8. $3 + 8 = 11$ |
| 9. $9 + 4 = 13$ | 10. $8 + 0 = 8$ |

Use the nomograph to find each difference.

- | | |
|------------------|------------------|
| 11. $5 - 1 = 4$ | 12. $10 - 6 = 4$ |
| 13. $13 - 9 = 4$ | 14. $18 - 9 = 9$ |
| 15. $17 - 8 = 9$ | 16. $11 - 8 = 3$ |
| 17. $16 - 8 = 8$ | |
| 18. $14 - 9 = 5$ | |
| 19. $15 - 7 = 8$ | |
| 20. $12 - 8 = 4$ | |

try
this

LESSON OUTCOME

Complete a basic addition (subtraction) fact and write a related subtraction (addition) fact

Materials

display board and cutouts

Vocabulary

related fact

Prerequisite Skills

Complete basic addition and subtraction facts

Checking Prerequisite Skills

Add.

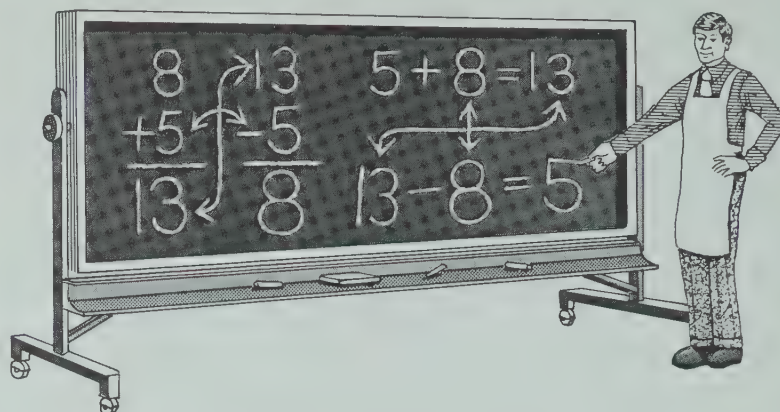
1. $4 + 7 = 11$ 2. $6 + 9 = 15$

Subtract.

3. $14 - 8 = 6$ 4. $18 - 9 = 9$

Relating Addition and Subtraction Facts

Addition and subtraction are related.



Addition facts can help you remember subtraction facts.

To find

$$\begin{array}{r} 15 \\ - 6 \\ \hline \end{array}$$

think

$$\begin{array}{r} 15 \\ + 6 \\ \hline 21 \end{array}$$

$$\begin{array}{r} 9 \\ + 6 \\ \hline 15 \end{array}$$

$$\begin{array}{r} 15 \\ - 6 \\ \hline 9 \end{array}$$

Working Together

Choose a related fact from the chalkboard to match each fact.

1. $\begin{array}{r} 10 \\ - 4 \\ \hline 6 \end{array}$

2. $\begin{array}{r} 6 \\ + 6 \\ \hline 12 \end{array}$

3. $\begin{array}{r} 12 \\ - 4 \\ \hline 8 \end{array}$

4. $15 - 9 = 6$
 $6 + 9 = 15$

5. $9 - 6 = 3$
 $3 + 6 = 9$

Give a related fact for each.

6. $\begin{array}{r} 14 \\ - 7 \\ \hline 7 \end{array}$

7. $\begin{array}{r} 8 \\ + 2 \\ \hline 10 \end{array}$

$\begin{array}{r} 8 \\ + 4 \\ \hline 12 \end{array}$	$\begin{array}{r} 12 \\ - 6 \\ \hline 6 \end{array}$	$\begin{array}{r} 6 \\ + 4 \\ \hline 10 \end{array}$
$6 + 9 = 15$	$3 + 6 = 9$	

Complete and give a related fact.

8. $12 - 9 = 3$ 9. $8 + 3 = 11$
 $3 + 9 = 12$ $11 - 3 = 8$

The other related fact is acceptable.

LESSON ACTIVITY

Before Using the Pages

- Establish that for every joining action there is a related separating action, and therefore, addition and subtraction are related. Have one child place eight cutouts on the display board. Have another child place two more cutouts on the display board. Ask how many there are in all and what the addition sentence is. Write the addition sentence on the board.

Have the child who placed the two cutouts on the display board remove them. Ask how many are left, and what the subtraction sentence is. Write the subtraction sentence beneath the addition sentence on the board. Repeat several times.

Reverse the procedure, and begin with a separating action. Place 14 cutouts on the display board. Have a child remove eight cutouts. Write the subtraction fact on the board. Have the child replace the eight cutouts. Write the

related addition fact on the board beneath the subtraction fact. Repeat several times.

Using the Pages

- The illustration compares a pair of related addition subtraction facts. The sum in the addition fact is the minuend in the subtraction fact. One of the addends in the addition fact is the difference in the subtraction fact.
- The worked example points out that knowing addition helps in recalling subtraction facts. You may wish to have the children illustrate the worked examples using cutouts on the display board.

Working Together: There are three stages in the development of the exercises. For Ex. 1-5, related facts are given for children to match. For Ex. 6 and 7, the children are asked to give a related fact for a given fact. Finally, for Ex. 8 and 9, the children are asked to complete a given sentence and write a related fact. Note that the given fact is addition or subtraction. Supply similar exercises at any stage needed.

Exercises

Write a related fact for each.

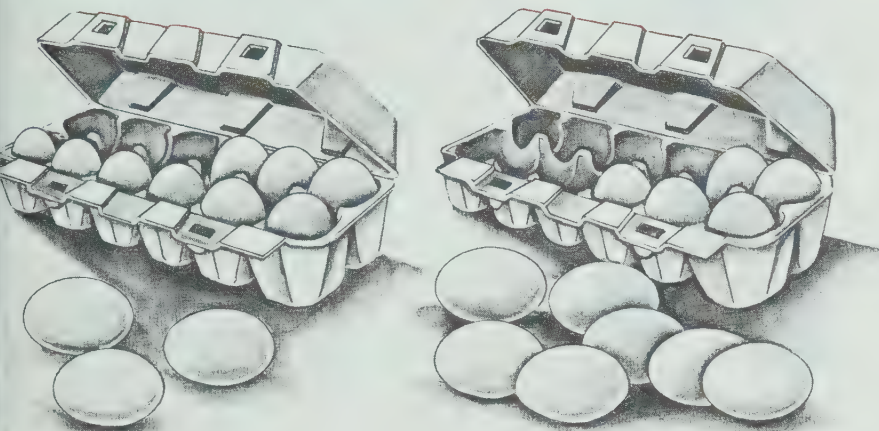
1. $11 - 8 = 3$
 $3 + 8 = 11$
2. $16 - 7 = 9$
 $9 + 7 = 16$
3. $8 + 8 = 16$
 $16 - 8 = 8$
4. $9 + 7 = 16$
 $16 - 7 = 9$
5. $10 - 3 = 7$
 $3 + 7 = 10$
6. $8 + 9 = 17$
 $9 + 8 = 17$
7. $14 - 5 = 9$
 $5 + 9 = 14$
8. $6 + 8 = 14$
 $14 - 8 = 6$
9. $15 - 8 = 7$
 $7 + 8 = 15$
10. $1 - 10 = -9$
 $-9 + 10 = 1$

Add or subtract. Then write a related fact for each.

1. $4 + 9 = 13$
 $13 - 9 = 4$
2. $12 - 7 = 5$
 $5 + 7 = 12$
3. $17 - 8 = 9$
 $9 + 8 = 17$
4. $6 + 7 = 13$
 $13 - 7 = 6$
5. $9 + 9 = 18$
 $18 - 9 = 9$
6. $17 - 9 = 8$
 $8 + 9 = 17$
7. $7 + 8 = 15$
 $15 - 8 = 7$
8. $11 - 4 = 7$
 $7 + 4 = 11$
9. $14 - 8 = 6$
 $6 + 8 = 14$
10. $9 + 3 = 12$
 $12 - 3 = 9$
11. $10 - 2 = 8$
 $8 + 2 = 10$
12. $14 - 9 = 5$
 $5 + 9 = 14$
13. $4 + 11 = 15$
 $15 - 11 = 4$
14. $15 - 6 = 9$
 $9 + 6 = 15$
15. $13 - 6 = 7$
 $7 + 6 = 13$
16. $3 + 11 = 14$
 $14 - 11 = 3$
17. $13 - 4 = 9$
 $9 + 4 = 13$
18. $7 + 12 = 19$
 $19 - 12 = 7$
19. $8 + 14 = 22$
 $22 - 14 = 8$
20. $12 - 4 = 8$
 $8 + 4 = 12$

Write an addition sentence and a related subtraction sentence for each of these.

1. $9 + 3 = 12$
 $12 - 3 = 9$
2. $5 + 7 = 12$
 $12 - 7 = 5$



RELATED ACTIVITIES

• Have a group of children sit in a circle. Each child is given a numeral card for one of the numbers from 0 to 10. Have one child stand in the center of the circle and show her/his numeral card to a player in the circle. That player silently adds the number to her/his own number and states the sum. The player in the center tries to identify the other player's number by subtracting her/his own number from the sum named. If correct, the player has earned another turn in the center.

Exercises: For Ex. 31 and 32, the children may begin with either an addition or a subtraction sentence, depending on whether they interpret the illustration as a joining action or a separating action.

Assessment

Add or subtract.

Write a related fact.

1. $8 + 11 = 19$
2. $13 - 4 = 9$
3. $7 + 14 = 21$
4. $17 - 9 = 8$

Answers may vary.

1. $11 - 8 = 3$
2. $9 + 4 = 13$
3. $14 - 7 = 7$
4. $8 + 9 = 17$

LESSON OUTCOME

Write two families of facts for a given pair of numbers

Prerequisite Skills

Write the family of addition and subtraction facts for a given addition or subtraction fact

Checking Prerequisite Skills

Write the complete family of facts.

- $3 + 7 = 10$ $10 - 7 = 3$ $10 - 3 = 7$
- $18 - 9 = 9$ $9 + 9 = 18$

RELATED ACTIVITIES

- Provide children with a set of cards that show dot patterns for 1 to 9. Have each child choose two cards and write the two families of addition and subtraction facts they suggest as shown below.



$$\begin{aligned} 8 + 5 &= 13 \\ 5 + 8 &= 13 \\ 13 - 5 &= 8 \\ 13 - 8 &= 5 \end{aligned}$$

$$\begin{aligned} 8 - 5 &= 3 \\ 8 - 3 &= 5 \\ 3 + 5 &= 8 \\ 5 + 3 &= 8 \end{aligned}$$

$$\begin{array}{llll} 1. 4+5=9 & 5-4=1 & 2. 4+9=13 & 9-4=5 \\ 5+4=9 & 5-1=4 & 9+4=13 & 9-5=4 \\ 9-5=4 & 1+4=5 & 13-9=4 & 5+4=9 \\ 9-4=5 & 4+1=5 & 13-4=9 & 4+5=9 \end{array}$$

Families of Facts

These two numbers are part of two families of facts.

One family uses 5, 8, and 13 because $5 + 8 = 13$.

$$\begin{array}{r} 5 \\ + 8 \\ \hline 13 \end{array} \quad \begin{array}{r} 8 \\ + 5 \\ \hline 13 \end{array} \quad \begin{array}{r} 13 \\ - 8 \\ \hline 5 \end{array} \quad \begin{array}{r} 13 \\ - 5 \\ \hline 8 \end{array}$$

One family uses 5, 8, and 3 because $8 - 5 = 3$.

$$\begin{array}{r} 8 \\ - 5 \\ \hline 3 \end{array} \quad \begin{array}{r} 8 \\ - 3 \\ \hline 5 \end{array} \quad \begin{array}{r} 3 \\ + 5 \\ \hline 8 \end{array} \quad \begin{array}{r} 5 \\ + 3 \\ \hline 8 \end{array}$$

Working Together

The facts within one family can be written in a different order.

For 3 and 6,

- give their sum. 9
- give their difference. 3
- give two families of facts.

For 8 and 4,

- give their sum. 12
- give their difference. 4
- give two families of facts.

Exercises

Write two families of facts for each pair of numbers.

- 4 and 5
- 4 and 9
- 1 and 4
- 5 and 9
- 1 and 5
- 5 and 6
- 3 and 3
- 6 and 9
- 3 and 8
- 4 and 7
- 7 and 5
- 6 and 6

$$\begin{array}{llll} 10. 4+7=11 & 7-4=3 & 11. 7+5=12 & 7-5=2 \\ 7+4=11 & 7-3=4 & 5+7=12 & 7-2=5 \\ 11-7=4 & 3+4=7 & 12-5=7 & 2+5=7 \\ 11-4=7 & 4+3=7 & 12-7=5 & 5+2=7 \end{array}$$

$$\begin{array}{ll} 12. 6+6=12 & 6-6=0 \\ 12-6=6 & 6-0=6 \\ 0+6=6 & 6+0=6 \end{array}$$

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LESSON ACTIVITY

Before Using the Page

Write the following exercises on the board.

- 8, 3, 5
- 4, 6, 10
- 9, 3

Ask the children to write the family of facts for each. They may suggest that you forgot to write the third number for Ex. 3. Ask if they can tell you what the third number is. Some children may suggest 12; others may suggest 6. Have a child write the family of facts for 9, 3, 12 on the board. Have another child write the family of facts for 9, 3, 6. Have the children discuss which family is the "right" family.

Using the Page

The worked example illustrates that for any two non-zero numbers there are two families of facts. After reading the worked example with the children, summarize the previous

activity by stating that both families are "right". Point out that one family begins with addition and the other family begins with subtraction.

Working Together: For each pair of numbers in these exercises, one family has four members and the other has two members. You may wish to have the children write the families for a pair of numbers such as 6 and 4, since each family has four members.

Exercises: Have the children follow the steps established in *Working Together*. They may write the sum of the two numbers in one column, the difference in a second column, and then complete each column with a family of facts.

Assessment

Write two families of facts for each pair of numbers.

- 4 and 9

$$\begin{array}{l} 4+9=13 \\ 9+4=13 \\ 13-9=4 \\ 13-4=9 \end{array}$$
- 8 and 8

$$\begin{array}{l} 4+5=9 \\ 5+4=9 \\ 9-5=4 \\ 9-4=5 \end{array}$$
- 2 and 4

$$\begin{array}{l} 8+8=16 \\ 16-8=8 \\ 0+8=8 \\ 8+0=8 \\ 8-8=0 \\ 8-0=8 \end{array}$$

LESSON OUTCOME

Add three one-digit numbers by grouping either the first two or the last two addends, sums to 18

Materials

a set of large cards showing from 0 to 9 dots

Prerequisite Skills

Complete basic addition facts

Checking Prerequisite Skills

Add.

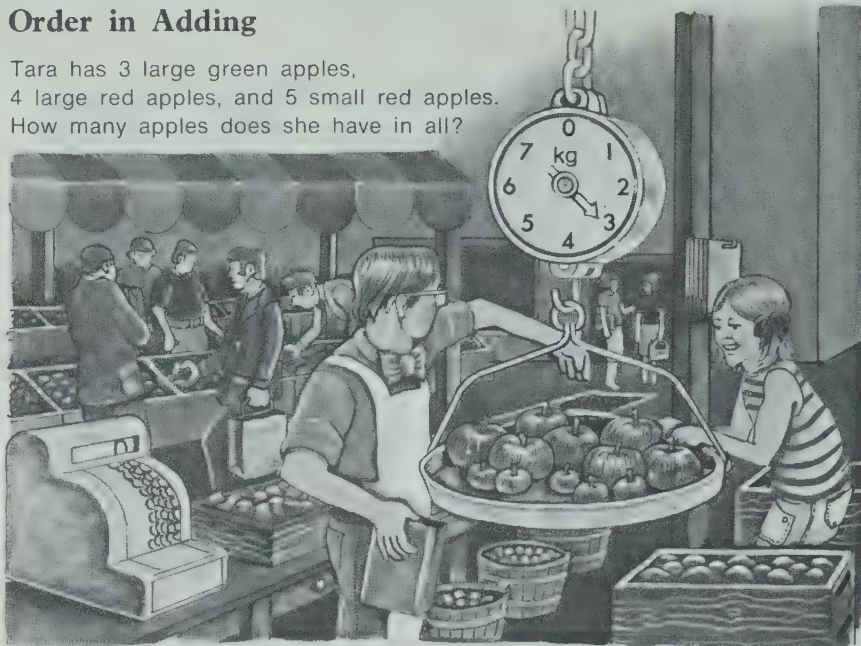
1. $3 + 4 = 7$ 2. $9 + 7 = 16$
3. $1 + 6 = 7$ 4. $5 + 8 = 13$

Background

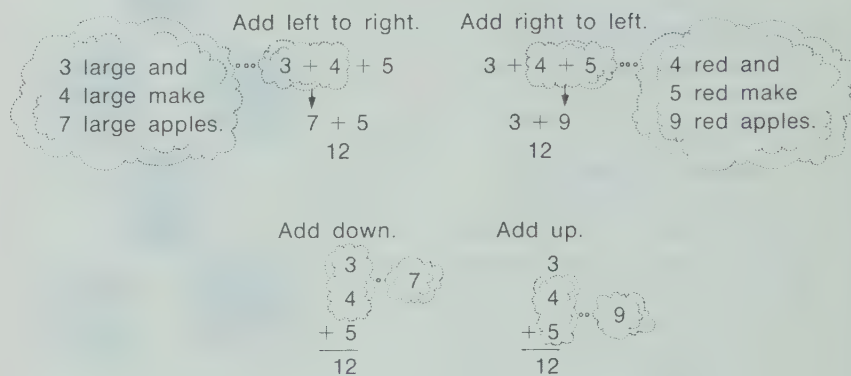
Only two numbers can be added at a time. If the sum of more than two numbers is required, the order of grouping the numbers does not affect the sum.

Order in Adding

Tara has 3 large green apples, 4 large red apples, and 5 small red apples. How many apples does she have in all?



Add $3 + 4 + 5$ in any order.



Tara has 12 apples in all.

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LESSON ACTIVITY

Before Using the Pages

- Use the cards showing dots to demonstrate the grouping property of addition. Place three cards in a row on the chalkboard ledge and facing the board so that the dots cannot be seen. Beginning at the left, turn the first card over and ask how many dots there are. Turn the second card over and ask how many dots there are on it. Slide the second card along the ledge so that it touches the first card and ask how many dots there are in all. Turn the third card over and ask how many dots there are on it. Slide the third card along the ledge so that it touches the second card and ask how many dots there are in all.

Reverse the procedure and begin at the right using the same three cards. Before completing the procedure, ask the children if they think the number of dots is different this time.

Repeat these two procedures for other sets of dot cards.

Using the Pages

- Guide the children through the four ways of adding 3, 4, and 5. Emphasize that the sum is not affected by the order adding the numbers. Point out the words that describe the method of adding, such as "Add left to right".

Working Together: The diagrams for Ex. 1 and 2 enable children to show the new addends resulting from grouping in two different ways. Some children may benefit from showing Ex. 3-8 in a similar manner. Ex. 3-12 enable children to practice addition using the four ways demonstrated on page 20. Repeating the addends for consecutive exercises emphasizes that grouping the addends differently does not affect the sum.

Working Together

Give the missing numbers.

1. $5 + 3 + 4$ $5 + 3 + 4$

$\downarrow 8$ $\downarrow 7$

$+ 4$ $+ 4$

$\downarrow 12$

2. $2 + 4 + 4$ $2 + 4 + 4$

$\downarrow 8$ $\downarrow 6$

$+ 4$ $+ 4$

$\downarrow 10$

Give the sums.

Add these left to right.	Add these right to left.
3. $6 + 1 + 2$ 9	4. $6 + 1 + 2$ 9
5. $4 + 5 + 1$ 10	6. $4 + 5 + 1$ 10
7. $3 + 0 + 4$ 7	8. $3 + 0 + 4$ 7

Add down.	Add up.
9. $\begin{array}{r} 1 \\ 4 \\ + 8 \\ \hline 13 \end{array}$	10. $\begin{array}{r} 1 \\ 4 \\ + 8 \\ \hline 13 \end{array}$
11. $\begin{array}{r} 3 \\ 2 \\ + 5 \\ \hline 10 \end{array}$	12. $\begin{array}{r} 3 \\ 2 \\ + 5 \\ \hline 10 \end{array}$

Exercises

Add left to right or right to left.

1. $7 + 2 + 6$ 15
2. $2 + 3 + 6$ 11
3. $4 + 6 + 2$ 12
4. $5 + 2 + 5$ 12
5. $4 + 2 + 7$ 13
6. $1 + 7 + 2$ 10
7. $1 + 2 + 3$ 6
8. $5 + 0 + 2$ 7

Add down or add up.

9. $\begin{array}{r} 2 \\ 2 \\ + 7 \\ \hline 11 \end{array}$
10. $\begin{array}{r} 1 \\ 6 \\ + 3 \\ \hline 10 \end{array}$
11. $\begin{array}{r} 4 \\ 4 \\ + 4 \\ \hline 12 \end{array}$
12. $\begin{array}{r} 3 \\ 4 \\ + 5 \\ \hline 12 \end{array}$
13. $\begin{array}{r} 4 \\ 4 \\ + 6 \\ \hline 14 \end{array}$
14. $\begin{array}{r} 6 \\ 3 \\ + 4 \\ \hline 13 \end{array}$
15. $\begin{array}{r} 4 \\ 3 \\ + 5 \\ \hline 12 \end{array}$
16. $\begin{array}{r} 5 \\ 1 \\ + 7 \\ \hline 13 \end{array}$
17. $\begin{array}{r} 2 \\ 6 \\ + 0 \\ \hline 8 \end{array}$
18. $\begin{array}{r} 9 \\ 7 \\ + 1 \\ \hline 17 \end{array}$
19. $\begin{array}{r} 5 \\ 5 \\ + 5 \\ \hline 15 \end{array}$
20. $\begin{array}{r} 4 \\ 1 \\ + 7 \\ \hline 12 \end{array}$

Solve.

21. 9 red apples.
1 green apple.
6 yellow apples.
How many apples in all? 16
22. 7 apples for Larry.
2 apples for Marcia.
7 apples for Rene.
How many apples in all? 16

RELATED ACTIVITIES

• Mark one die with 0, 1, 2, 3, 4, 5; a second die with 0, 1, 2, 3, 4, 4; and a third die with 4, 5, 6, 7, 8, 9. Have children take turns tossing the dice and finding the sum of the three numbers shown. Answers may be given orally or in writing.

Exercises: Tell the children to consider each exercise independently and choose the method of grouping they prefer. You may wish to have them ring one pair of addends for each exercise to show the order they chose.

For Ex. 21 and 22, have the children write an addition exercise using either the horizontal or the vertical form, and then answer the question in a sentence.

Assessment

1d.

$\begin{array}{r} 4 \\ 5 \\ + 2 \\ \hline 11 \end{array}$

$\begin{array}{r} 6 \\ 8 \\ + 0 \\ \hline 14 \end{array}$

$4 + 4 + 3$ 11

$1 + 9 + 2$ 12

$6 + 2 + 4$ 12

OBJECTIVE

Draw a picture and write either an addition or a subtraction sentence to solve a problem

Background

Page 22 is the first of the special problem-solving pages in this book. See page xv for comments on the approach to problem solving.

RELATED ACTIVITIES

- Encourage the children to make up problems of their own for other children to solve by drawing pictures. You may prefer to have children dramatize problem situations.

Thinking of a Picture

Thinking of a picture for a problem can help you write a number sentence to solve the problem. Study these examples.

John had 3 cookies.
He bought 8 cookies.
How many cookies does he have in all?



Use addition when you join two groups.

$$3 + 8 = 11$$

11 cookies in all.

Jean had 8 cookies.
She ate 3 cookies.
How many cookies are left?



Use subtraction when you take away.

$$8 - 3 = 5$$

5 cookies are left.

Jan ate 8 cookies.
Ed ate 3 cookies.
How many more did Jan eat?



Use subtraction when you compare.

$$8 - 3 = 5$$

Jan ate 5 more than Ed.

Choose the number sentence that fits each problem.

1. I had 6 tickets.
I sold 2 tickets.
How many tickets do I have left?

$$6 + 2 =$$

$$6 - 2 = 4$$

2. I have 11 dimes.
You have 6 dimes.
How many more dimes do I have?

$$11 + 6 =$$

$$11 - 6 = 5$$

3. I ate 9 gumdrops.
You ate 6 gumdrops.
How many gumdrops did we eat in all?

$$9 + 6 = 15$$

$$9 - 6 =$$

Write a number sentence and answer each question.

4. I had 10 records.
I broke 2 records.
How many records are left? $10 - 2 = 8$

5. I have 6 red marbles and 4 green marbles.
How many marbles do I have in all? $6 + 4 = 10$

6. I made 15 cupcakes.
I gave away 8.
How many cupcakes are left? $15 - 8 = 7$

7. I used 6 stamps.
You used 13 stamps.
How many more did you use? $13 - 6 = 7$

8. I saw 5 robins.
You saw 6 blue jays.
How many birds did we see in all? $5 + 6 = 11$

PROBLEM SOLVING

The addition sentences with the addends in the opposite order are acceptable.

LESSON ACTIVITY

Using the Page

- Read the introduction and examples. For each example, have the children name the words that suggest addition (in all) and the words that suggest subtraction (are left, how many more).
- Discuss the pictures that accompany the examples. Point out how the symbols indicate the action involved in solving each problem. Discuss the value of representing a problem with a very simple diagram and the value of representing the ideas using one's own method.

Exercises: Tell the children to draw a picture for each problem.

Assign the exercises to children who are able to work independently. For the other children, work with small groups. When necessary, help children read the problems.

Checking Up

Add.

1. $3 + 2 = 5$
2. $1 + 6 = 7$
3. $3 + 3 = 6$
4. $7 + 1 = 8$
5. $9 + 9 = 18$
6. $5 + 8 = 13$
7. $8 + 7 = 15$
8. $4 + 8 = 12$
9. $\begin{array}{r} 3 \\ + 5 \\ \hline 8 \end{array}$
10. $\begin{array}{r} 2 \\ + 8 \\ \hline 10 \end{array}$
11. $\begin{array}{r} 3 \\ + 4 \\ \hline 7 \end{array}$
12. $\begin{array}{r} 2 \\ + 4 \\ \hline 6 \end{array}$
13. $\begin{array}{r} 0 \\ + 9 \\ \hline 9 \end{array}$
14. $\begin{array}{r} 4 \\ + 5 \\ \hline 9 \end{array}$
15. $\begin{array}{r} 6 \\ + 7 \\ \hline 13 \end{array}$
16. $\begin{array}{r} 8 \\ + 5 \\ \hline 13 \end{array}$
17. $\begin{array}{r} 9 \\ + 6 \\ \hline 15 \end{array}$
18. $\begin{array}{r} 9 \\ + 3 \\ \hline 12 \end{array}$
19. $\begin{array}{r} 3 \\ + 4 \\ \hline 7 \end{array}$
20. $\begin{array}{r} 1 \\ + 5 \\ \hline 6 \end{array}$

Subtract.

21. $10 - 8 = 2$
22. $4 - 2 = 2$
23. $8 - 0 = 8$
24. $9 - 3 = 6$
25. $13 - 6 = 7$
26. $15 - 6 = 9$
27. $11 - 8 = 3$
28. $11 - 3 = 8$
29. $\begin{array}{r} 7 \\ - 5 \\ \hline 2 \end{array}$
30. $\begin{array}{r} 6 \\ - 2 \\ \hline 4 \end{array}$
31. $\begin{array}{r} 5 \\ - 3 \\ \hline 2 \end{array}$
32. $\begin{array}{r} 7 \\ - 1 \\ \hline 6 \end{array}$
33. $\begin{array}{r} 10 \\ - 4 \\ \hline 6 \end{array}$
34. $\begin{array}{r} 9 \\ - 9 \\ \hline 0 \end{array}$
35. $\begin{array}{r} 12 \\ - 4 \\ \hline 8 \end{array}$
36. $\begin{array}{r} 13 \\ - 9 \\ \hline 4 \end{array}$
37. $\begin{array}{r} 12 \\ - 6 \\ \hline 6 \end{array}$
38. $\begin{array}{r} 14 \\ - 8 \\ \hline 6 \end{array}$
39. $\begin{array}{r} 11 \\ - 5 \\ \hline 6 \end{array}$
40. $\begin{array}{r} 14 \\ - 6 \\ \hline 8 \end{array}$

Subtract. Then write a related addition fact.

- The other related fact is acceptable.
41. $7 - 4 = 3$ 42. $17 - 9 = 8$
 $3 + 4 = 7$ $8 + 9 = 17$

Write a number sentence and answer each question.

45. 5 green apples.
12 red apples. $12 - 5 = 7$
How many more red apples? 7
47. Buy 10 plums.
Eat 3 plums. $10 - 3 = 7$
How many are left? 7
49. 7 lemons.
Buy 4 more. $7 + 4 = 11$
How many lemons in all? 11
46. 6 bananas.
9 oranges. $6 + 9 = 15$
How many pieces of fruit? 15
48. Phil ate 8 grapes. Ellen ate 9 grapes. How many $8 + 9 = 17$ grapes did they eat in all? 17
50. 14 limes.
9 grapefruit. $14 - 9 = 5$
How many fewer grapefruit? 5

23

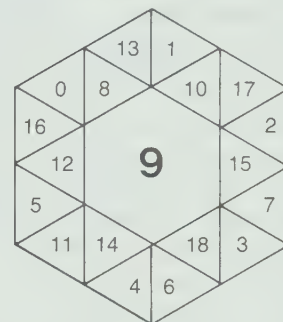
OBJECTIVE

Demonstrate an understanding of the concepts and skills presented in this unit

RELATED ACTIVITIES

- Children may enjoy practicing basic addition and subtraction facts by playing the game "Lucky Nine" in groups of two or three.

Materials: game board as shown; 15 markers per player; basic fact cards (addition and subtraction).



Rules:

- The cards are shuffled and placed face down in a pile.
- The first player turns one card up and states the number sentence for the number fact shown. For example, for the card $\boxed{6 + 2}$ the player states " $6 + 2 = 8$ ". Then the player places a marker on the space for 8 on the game board. If there is a marker on the space for 8 already, the player removes it and places it in her/his pile of markers, instead of placing a marker on the game board.
- A player who obtains a number fact card for 9 claims all the markers on the game board.
- The game ends when one player has no more markers.
- The winner is the player who has the most markers.

Skills	Exercises	Related Pages
Add, sums to 10	1-4, 9-14	T2-T3
Add, sums to 18	5-8, 15-18	T10-T11
Subtract, minuends to 10	21-24, 29-34	T6-T9
Subtract, minuends to 18	25-28, 35-40	T12-T13
Add with three addends	19, 20	T20-T21
Subtract, give a related fact	41, 42	T16-T19
Add, give a related fact	43, 44	T16-T19
Solve addition problems	46, 48, 49	
Solve subtraction problems	45, 47, 50	

Comments

Immediate recall of basic addition and subtraction facts is important for mastery of addition and subtraction skills. All children should review basic facts frequently. Children who tend to forget the basic facts require a short daily drill. The activities and games suggested in Unit 1 provide different methods of drill.

Unit 2 Overview

Numeration

This unit deals primarily with place-value concepts because an understanding of place value is essential for subsequent work involving regrouping in addition and subtraction, and also for work with decimals. First, the concept of hundreds, tens, and ones is reviewed. Then, place-value relationships are investigated further as children show regrouping, write numbers in expanded form, and compare and order numbers. An application of place value is provided in work with amounts of money to \$9.99. Other topics related to numeration are included. Work with fractions begins with parts of a whole for halves, thirds, fourths, and tenths, and extends to mixed numbers less than ten. Practical uses of numbers are considered in work with the calendar and with telling time on a dial clock and a digital clock.

Lesson Outcomes

- read and write standard numerals and words for numbers to 999
- interpret place value for numbers to 999
- write the expanded form for numbers to 999
- regroup with numbers to 999
- compare and order numbers to 999
- recognize and use the symbols $>$ and $<$ for *is greater than* and *is less than*
- complete number sequences and patterns in number squares
- read and write numerals and words for amounts of money less than ten dollars
- read and write words and numerals for fractions less than one and mixed numbers less than ten for halves, thirds, fourths, tenths
- read and write words and numerals for ordinal numbers to *thirty-first* and use these numbers to identify positions
- use a calendar to identify dates
- show times and write numerals and words for times at five-minute marks
- solve certain word problems without using numbers

Background

Children usually begin their study of numbers with rote counting activities and then learn to associate each number name in order with the corresponding numeral and number of objects. Because it is particularly important that children learn to write the digits correctly, it may be necessary to reteach their formation with emphasis on accuracy and neatness. The words *number*, *numeral*, and *digit* are encountered both formally and informally in this unit. Confusion often arises as to their correct usage. Briefly, a number is an abstract idea. A numeral is any symbol that represents a number. For example, some numerals for the number "three" are

3 three 2 + 1 1 × 3
trois 27 ÷ 9 98 - 95

In our numeration system, numerals are written using one or more of the ten Hindu-Arabic digits, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. Thus, 3, for instance, is both a digit and a numeral. The numeral 25 is made up of two digits, 2 and 5, which, together in this particular order, name the number "twenty-five". It is correct to ask a child to write the *numeral* for twenty-five since one cannot write a *number*. On the other hand, we add numbers, not

numerals. While teachers are encouraged to use these words correctly, they are also cautioned against making an issue of the correct usage with children. Children usually have an intuitive understanding of the terms *number* and *numeral*, and raising the issue at this time may create more confusion than clarification. In general, if there is doubt as to which word should be used, use the word *number*.

Showing numbers in expanded form reinforces the concept of place value since the total value of each digit (except 0) in the numeral is clearly expressed, as seen in the following examples:

Standard Form	Expanded Form
452	$400 + 50 + 2$
630	$600 + 30$
108	$100 + 8$

For the base-ten numeration system, two or more of the digits 0 to 9 are needed to represent numbers greater than 9. This is accomplished with grouping by tens. The number of groups of ten ones is represented by a digit in the *tens' place* (to the left of the ones' digit). The number of groups of ten tens is represented by a digit in the *hundreds' place* (to the left of the tens' digit) and so on. The position of a digit, then, is important since it determines the value of the digit.

	hundreds	tens	ones	standard form
twenty-three		2	3	23
thirty-two		3	2	32
two hundred three	2	0	3	203

The importance of 0 as a place-holder cannot be overemphasized. For example, using 0 with 2 and 3 gives numerals for three different numbers — 23, 203, and 230.

The work on pages 30 and 31 prepares children for addition and subtraction with regrouping. In addition, for instance, a sum may need to be regrouped to show the standard form as in A; where in subtraction, the subtrahend may need to be regrouped to show, for example, more ones as in B.

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Teaching Strategies

It is well known that children learn abstract concepts through concrete experiences. Teachers need to ensure that children are given many opportunities to investigate concepts using materials such as Multibase Arithmetic Blocks (similar to those illustrated on page 26), Unifix cubes, cardboard strips and square counters, sticks or straws bundled in groups of ten. This is particularly important if children are meeting concepts and skills for the first time. The teaching should be initiated with concrete models and their use should be continued as long as their support is needed. Keep in mind that children need time to familiarize themselves with new materials in order to feel comfortable with their use in formal lessons, and that experiences with different kinds of place-value models can help to strengthen the concept

the number of materials available is limited, have children work in small groups.

Some children may still need experiences in grouping objects into sets of ten. Egg cartons cut down to ten sections are particularly effective devices. Children can place one counter in each section of the carton. A “filled” carton holding ten counters represents *one ten*. Ten of these cartons may be grouped together to show *one hundred*. Children may use the counters to represent numbers. Afterward, they should verbalize the grouping of ones, tens, and hundreds and associate the grouping with the correct numeral. Many children will be able to work in a semi-concrete manner, drawing pictures as suggested in the exercises on page 27 or using a place-value pocket chart or abacus (see page T 348).

While the learning process begins in the concrete experience, the teacher must be instrumental in assisting the child to draw the concept, to consolidate it, and to internalize it. This last step will require considerable practice and drill, frequently more than can be provided within the confines of a textbook. To assist the teacher, various games and related activities are provided for each lesson.

The adoption of the metric system of measurement has led to increased emphasis on decimals and a decreased emphasis on fractions. Nevertheless, an understanding of basic fraction concepts and standard notation is necessary. Children need opportunities to fold, cut, and color shapes to show the various fraction parts, and to become familiar with fraction names and numerals. In preparation for an early introduction of decimal concepts, pay particular attention to the teaching of tenths.

Much of the work of Unit 2 will be new for the children of your class. You may wish to spend a few extra days to consolidate the concepts of the unit at this time, or you may plan to omit certain lessons and teach them just before they are met in context. For example, regrouping numbers may be delayed until Unit 3 (addition) and Unit 5 (subtraction). The lessons on fractions may be included in a study of two-dimensional shapes during the study of geometry (Unit 4 and Unit 10).

Materials

• Demonstration number line marked from 0 to 100
 • Models for hundreds, tens, and ones
 • Folding paper banner that shows 538 when folded and 500 30 8 when unfolded (for pages 28 and 29)
 • Flash cards for *is greater than*, *is less than*, and the symbols $>$ and $<$
 • Numerical card for a number less than 10 for each child
 • Real money, play money, or cutouts from pages T 351 and T 352
 • Pieces of circular paper or filter paper for each child
 • Cutouts of shapes, some that show thirds and some that show tenths, tracing paper
 • Play board, 16 circular cutouts the same size, four of which are colored to show halves, thirds, fourths, and tenths, respectively
 • Several calendars for the current year, two copies of page T 353
 • For each child, old calendars or a copy of a *World Almanac*
 • Paper plate, metal fastener, and two cardboard hands for each child to make a clock face
 • A dial clock or demonstration clock face, digital clock (optional), a copy of page T 354 for each child
 • Balance scales and objects referred to in the problems on page 46 (optional)
 • Overhead projector

Vocabulary

digit	hundreds, tens, ones	least, greatest
numeral	is greater than	is less than
regroup	pattern square	diagonal
date	yesterday, tomorrow	today
calendar	day, week, month, year	dial clock
leap year	standard form	expanded form
cent	penny, dime, dollar	amount
o'clock	minute hand, hour hand	digital clock
heavier	shortest, longest	equal
younger	taller, deeper, farther	equally
colder	larger	faster
number names <i>zero to nine hundred ninety-nine</i>		
ordinal names <i>first to thirty-first</i>		
names of fractions less than one and mixed numbers less than ten		
for halves, thirds, fourths, tenths		
names of the days of the week, names of the months of the year		
words for times at five-minute marks		

LESSON OUTCOME

Read and write standard numerals and words for numbers to 99

Materials

demonstration number line for 0 to 99

Vocabulary

digit, numeral, word names for numbers to ninety-nine

Prerequisite Skills

Read and write standard numerals and words for the numbers 0 to 9

Checking Prerequisite Skills

Copy and complete.

1. 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

Write in order.

2. four, zero, six, eight, one,
three, five, two, seven, nine
zero, one, two, three, four,
five, six, seven, eight, nine

Background

A number is an idea and is expressed by using symbols called *numerals*. Children should be aware that there is a difference between numbers and their numerals. However, unless children are sure of the difference, it is preferable that they use the word *number*.

2 NUMERATION

Numbers to 99

Numbers help us line up,
Numbers tell who's best.

They tell us what the day is,
They tell us when to rest.

Numbers show how many,
Numbers show the cost.

They tell us to enjoy ourselves,
They help us when we're lost.

Numbers tell how long it takes,
Numbers tell how far.

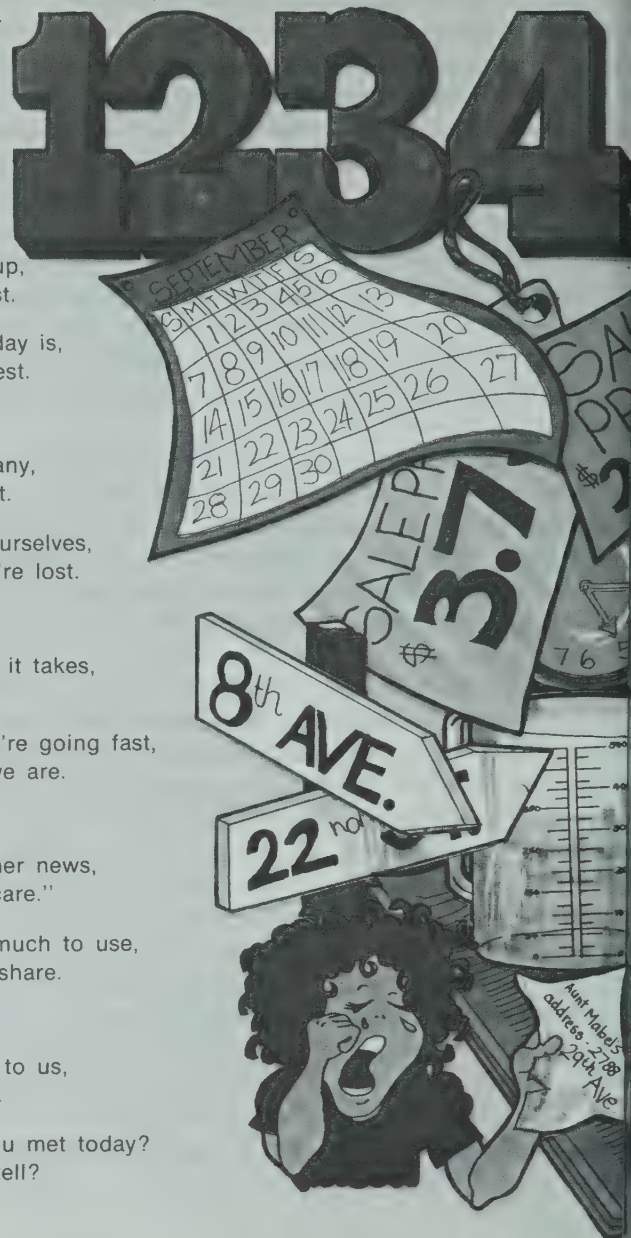
They slow us when we're going fast,
They show us where we are.

Numbers tell the weather news,
Numbers warn "Take care."

They tell us just how much to use,
They show us how to share.

Numbers say so much to us,
Numbers serve us well.

What numbers have you met today?
What stories did they tell?



24

LESSON ACTIVITY

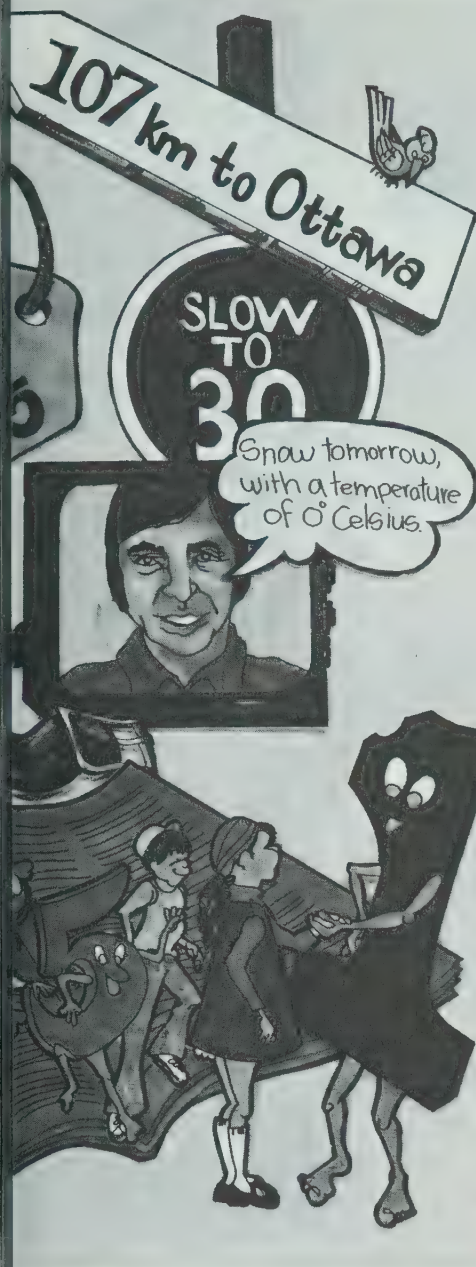
Before Using the Pages

- Display a number line for 0 to 99. Point to several numerals in turn. Have children identify the numbers. Name several numbers in turn. Have children point to the numerals. Begin with the numbers from zero to nineteen. Then deal with multiples of ten to 90, and finally the remaining numbers. Introduce the word *digit* and point out that numbers from ten to ninety-nine are represented by numerals having two digits.
- Have children refer to the number line as needed to answer questions similar to the following.
"What number comes after (before) ____?"
"What number comes between ____ and ____?"
"Which is greater (less), ____ or ____?"
- Have the children count by twos, by fives, and by tens.

- Tap each child on the shoulder, and have the children count aloud to determine the number of children in the class. Write the numeral on the board. Count the pieces of clothing in a new box or the books on a shelf. Write the numeral on the board.
- Help the children prepare a list of numerals and words for numbers from zero to twenty, the remaining multiples of ten to 90, and a selection of other numbers. Show how hyphen is used to join two words to form the word name for another number, for example, "sixty-one".

Using the Pages

- The illustrated poem provides an opportunity to discuss the application of numbers and their importance in everyday life. Read the poem and match the illustrations with the contents of the poem. Have the children discuss their own experiences with numbers.



Working Together

Count

1, 2, 3, 4, 5, 6, 7, 8, 9, 10 11, 12, 13, 14, 15, 16, 17, 18, 19, 20

1. from 1 to 10. 2. from 11 to 20.

3. from 23 to 28. 4. from 56 to 63.
23, 24, 25, 26, 27, 28 56, 57, 58, 59, 60, 61, 62, 63

Show the rest of this table to 99.

5.

eleven	11	fifty-five	55
twenty-two	22	sixty-six	66
thirty-three	33	seventy-seven	77
forty-four	44	eighty-eight	88
		ninety-nine	99

Write the numerals.

6. forty-seven ⁴⁷ 7. thirteen ¹³

Write the words.

8. 52 fifty-two 9. 18 eighteen 10. 70 seventy

Exercises

Write the numerals 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76

1. from 31 to 37. 2. from 65 to 76.

3. from 7 to 20. 4. from 35 to 54.

Write the numerals 43, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54

5. eighty-four ⁸⁴ 6. thirty-nine ³⁹

7. fifteen ¹⁵ 8. ninety ⁹⁰

9. twenty-six ²⁶ 10. twelve ¹²

11. seventy-one ⁷¹ 12. fifty-seven ⁵⁷

Write the words.

13. 63 14. 14 15. 30

16. 11 17. 95 18. 44

19. 28 20. 87 21. 78

13. sixty-three 14. fourteen 15. thirty
16. eleven 17. ninety-five 18. forty-four
19. twenty-eight 20. eighty-seven 21. seventy-eight

RELATED ACTIVITIES

- You may wish to give each child a copy of page T 360 on which to write the numerals 0 to 99 in order. Flash cards and oral instructions may be used with the chart. For example,

“Color the square for this number red.”

fifty-two

“For sixty-eight to seventy-three color the squares blue.”

“Mark an X for all the numbers that belong in this pattern: eleven, twenty-two, thirty-three, forty-four,”

- The children may enjoy preparing a classroom display illustrating the use of numbers. They may cut pictures from magazines or draw their own pictures to match ideas in the poem. Perhaps they may even wish to write their own poem.
- You may wish to have the children familiarize themselves with models for tens and ones and experiment with representing numbers to 99.

Working Together: Have a child read aloud the instructions that precede the exercises.

Children who need practice may write the numerals for Ex. 1-4. Otherwise, those may be done orally and Ex. 5-10 in writing. Have a few children work at the board instead of at their desks. Note how Ex. 5 suggests a pattern of counting by elevens.

Exercises: Some children may need to refer to the list prepared earlier in the lesson activity for help with spelling number words.

- For further practice, have the children name the number that comes after (before) the number named in the exercise and also order the numbers given in Ex. 13-21.

Assessment

Write the numerals.

1. from 39 to 44. 39, 40, 41, 42, 43, 44

Write the words.

2. 12 twelve 3. 40 forty 4. 85 eighty-five

Write the numerals.

5. seventeen 17 6. ninety-eight 98

LESSON OUTCOME

Read and write standard numerals and words for numbers to 999; interpret place value in numerals to 999

Materials

models for hundreds, tens, and ones

Vocabulary

hundreds, tens, ones, names for numbers to nine hundred ninety-nine

Prerequisite Skills

Read and write standard numerals and words for the numbers to 99

Checking Prerequisite Skills

Write the numerals.

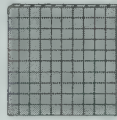
1. twenty **20** 2. seventy-nine **79**

Write the words.

3. 13 **thirteen** 4. 40 **forty** 5. 93 **ninety-three**

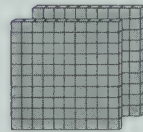
Numbers to 999

This shows one hundred.



100

This shows two hundreds.



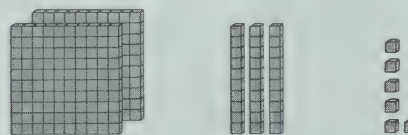
200

This shows three tens and six ones or thirty-six.



36

This shows two hundred thirty-six.



236

26



LESSON ACTIVITY

Before Using the Pages

- As a warm-up, have the children rote count from 81 to 90. Ask what number comes after 99. Write the numeral 100 and the words *one hundred* on the board. Have children write numerals and words on the board for multiples of one hundred to 900.
- Use models for hundreds, tens, and ones. Have the children examine the models and tell which show ones, which show tens, and which show hundreds. Use the models to represent numbers. Draw a chart on the board and record how each number is represented.

237 = ____ hundreds ____ tens ____ ones

460 = ____ hundreds ____ tens ____ ones

508 = ____ hundreds ____ tens ____ ones

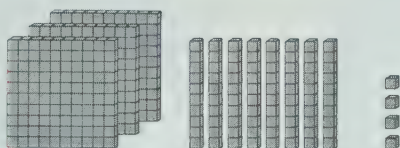
Using the Pages

- The models pictured here are used throughout the text to represent whole numbers. Read the example with the children to familiarize them with the models shown for hundreds, tens, and ones, especially if the models used in the classroom differ from those illustrated on the page.
- Point out the word name “two hundred thirty-six” at the bottom of page 26. Have the children use their hands to cover some of the models for 236 and show new numbers as follows. Ask what number would be shown if you were to remove or cover 2 ones (234) or 6 ones (230). Have children write the numeral and the word for each.

Working Together: The progression of Ex. 1-7 will help identify the children’s ability to recognize the place value of each digit in a three-place numeral. Note that this is examined first with the aid of models and then without models. The remaining exercises involve translating from word names to numerals and vice versa. Have children use their models if necessary.

For this picture,

1. how many hundreds? 3
2. how many tens? 8
3. how many ones? 4
4. how many in all? 384



In the numeral 308,

5. how many hundreds? **3** 6. how many tens? **0** 7. how many ones? **8**

Write the numerals.

8. six hundred
600
9. four hundred thirty-five
435
10. eight hundred nine
809

Write the words.

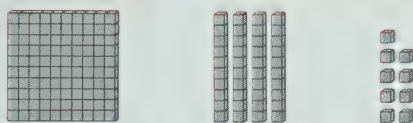
- | | | | |
|--------------|---------------------|-------------------|---------------------------|
| 11. 500 | 12. 840 | 13. 603 | 14. 278 |
| five hundred | eight hundred forty | six hundred three | two hundred seventy-eight |

Exercises

5. □□□□□□□□□□□□□□ 6. □□□□
7. □□□□□□□□□□□□□□ 8. □□□□□□□□□□□□□□□□□□□□
9. □□□□□□□□□□□□□□□□□□□□ 10. □□□□□□□□□□□□□□□□□□□□

For this picture

1. how many hundreds? 1
2. how many tens? 4
3. how many ones? 9
4. how many in all? 149



Use for hundreds, for tens, for ones.

Draw pictures to show each of these.

5. 750 6. 400 7. 816 8. 698 9. 765 10. 577

Write the numerals.

- | | |
|---|--|
| 11. ²¹⁹ two hundred nineteen | 12. ⁹⁸² nine hundred eighty-two |
| 13. ⁵⁰⁰ five hundred | 14. ³⁶⁰ three hundred sixty |
| 15. ⁷⁰¹ seven hundred one | 16. ¹¹¹ one hundred eleven |

Write the words.

- | | | | | | |
|--------------------------------|------------------------------|---------|---------|---------|---------|
| 17. 783 | 18. 110 | 19. 412 | 20. 203 | 21. 900 | 22. 344 |
| 17. seven hundred eighty-three | 18. one hundred ten | | | | |
| 19. four hundred twelve | 20. two hundred three | | | | |
| 21. nine hundred | 22. three hundred forty-four | | | | 27 |

27

- Have children work in pairs using models and an abacus chart for hundreds, tens, and ones. One child represents a number by placing models on the chart. The other child writes the standard numeral. The order of this procedure may be reversed and children may change roles from time to time.

hundreds	tens	ones

- Abacus charts that are covered with acetate are useful. A nonpermanent marker can be used to draw diagrams of hundreds, tens, and ones. Numerals can be written at the bottom of each column. Marks are easily removed before a new exercise is begun.

1	3	5
---	---	---

- Name “number trios” similar to the following and have children write the numerals and the words.

4, 34, 134; 0, 60, 560; 4, 40, 402

- Have children write as many different numerals as they can using the same three digits, for example, 2, 7, and 8. Three of the numerals are 728, 782, and 872. This activity emphasizes that the place value of a digit changes according to its position in a numeral. Have the children write the word name for each number.

Exercises: Some children may benefit from using models to represent numbers. Discuss the use of the simple diagrams shown for Ex. 5-10 to represent the numbers instead of models or illustrations of models.

Assessment

Write the numerals.

1. six hundred **600** 2. two hundred one **201**

Write the words.

3. 812 4. 190 5. eight hundred twelve
6. 400 7. 100 4. one hundred ninety

Complete the following.

5. $329 = \underline{3}$ hundreds $\underline{2}$ tens $\underline{9}$ ones
6. 7 hundreds 5 tens 0 ones = $\underline{750}$

LESSON OUTCOME

Write the expanded form for numbers to 999

Materials

models for hundreds, tens, and ones, a folding paper banner that shows 538 when folded and 500 30 8 when unfolded, overhead projector

Vocabulary

standard form, expanded form, diagonal

Prerequisite Skills

Write the numerals and words for the numbers to 999

Checking Prerequisite Skills

Write the words. eight hundred three

1. 427 2. 803

four hundred twenty-seven

Write the numerals.

3. three hundred six 306

4. five hundred fifty 550

Background

Showing a number in expanded form emphasizes the value of each digit because of its place in the numeral. Note that the expanded form for a number shows the value represented by each digit in the numeral with the exception of zero, as seen in the following examples.

$$281 = 200 + 80 + 1 \quad 503 = 500 + 3$$

LESSON ACTIVITY

Before Using the Pages

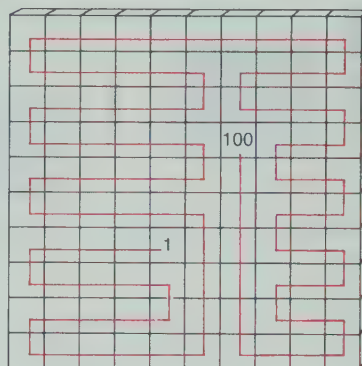
- Write the following numerals on the board before the lesson (or prepare an overhead transparency for projecting the numerals on the board). Conceal the numerals during the rote counting activity, but reveal them for activities that involve ringing the appropriate numerals.

1, 2, 3, 4, 5, 6, 7, 8, 9
10, 20, 30, 40, 50, 60, 70, 80, 90
100, 200, 300, 400, 500, 600, 700, 800, 900

- Rote count by ones to 9, by tens to 90, and by hundreds to 900. This serves as a warm-up activity and introduces the numbers used in expanded form.
- Use models for hundreds, tens, and ones. Display 3 hundreds. Ask what number is shown. Have a child ring the numeral 300. Display 2 tens and repeat the procedure. Display 5 ones and repeat the procedure. Join the three groups of models and ask what number is shown. Write the numeral

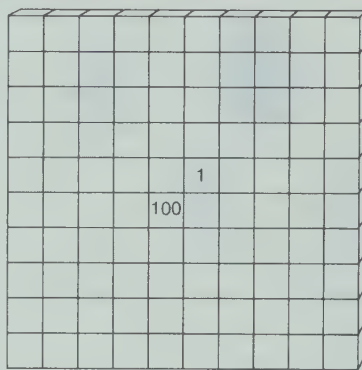
Different solutions are possible.

Place tracing paper over these 100 blocks.



- Start at 1 and draw a path to 100. Cross each block just one time. (Move left or right or up or down only. No diagonal moves allowed.)
- Now try this one.

There is no solution.



try this

28

Expanded Form

Both flags show the number 538.



Working Together

Show each number in expanded form.

Example: $538 = 500 + 30 + 8$

- 257 2. 780 3. 403
200+50+7 700+80 400+3

Show each number in standard form.

Example: $300 + 20 + 1 = 321$

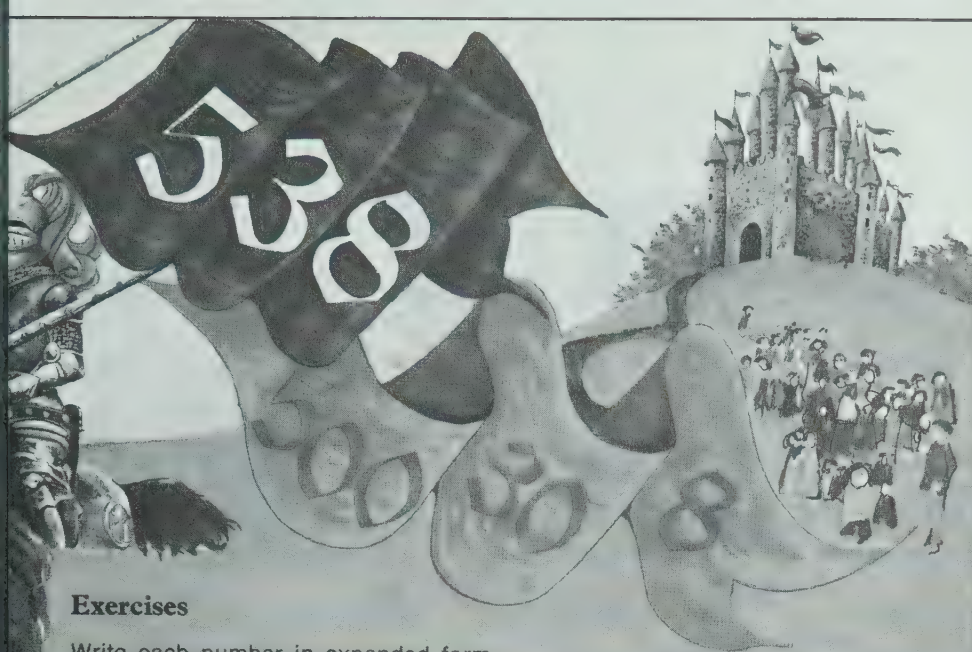
- $800 + 10 + 7$ 817 5. $100 + 6$ 106
- $600 + 40$ 640 7. $70 + 5$ 75

325. Indicate the three groups of models separately and then together. Tell the children that 3 hundreds 2 tens 5 ones is another name for three hundred twenty-five. Use other examples with models as needed.

- Ring numerals such as 400 and 80. Have children write the standard numeral (480). Write a numeral such as 603. Have children ring the numerals for showing it in expanded form (600 and 3).

Using the Pages

- Explain that the two banners show the same number in different forms. Introduce the terms *standard form* and *expanded form*. Demonstrate the two forms using a folding paper banner similar to the one shown on page 29. Write the sentence $538 = 500 + 30 + 8$ on the board and point out that the symbols = and + are not on the banners. Have a child write the words for 538 on the board.



Exercises

Write each number in expanded form.

1. 675 $600 + 70 + 5$
2. 376 $300 + 70 + 6$
3. 930 $900 + 30$
4. 101 $100 + 1$
5. 745 $700 + 40 + 5$
6. 540 $500 + 40$
7. 417 $400 + 10 + 7$
8. 221 $200 + 20 + 1$
9. 884 $800 + 80 + 4$
10. 906 $900 + 6$

Write each number in standard form.

11. $400 + 20 + 7$ 427
12. $900 + 10 + 6$ 916
13. $300 + 30$ 330
14. $800 + 2$ 802
15. $200 + 70$ 270
16. $500 + 5$ 505

Write each number in expanded form.

Example: For eight hundred forty-nine, write $800 + 40 + 9$

17. three hundred eighty-two $300 + 80 + 2$
18. six hundred fifty $600 + 50$
19. seven hundred three $700 + 3$
20. two hundred nine $200 + 9$
21. one hundred ninety $100 + 90$
22. five hundred twelve $500 + 10 + 2$

Write the words.

Example: For $200 + 70 + 6$, write two hundred seventy-six

23. $700 + 30 + 2$
24. $500 + 20$
25. $600 + 8$
26. $100 + 60$
27. $300 + 10 + 1$
28. $400 + 40 + 4$
29. seven hundred thirty-two
30. five hundred twenty
31. six hundred eight
32. one hundred sixty
33. three hundred eleven
34. four hundred forty-four

RELATED ACTIVITIES

- Children may complete work sheets similar to the following.

234	$600 + 80 + 9$
903	$200 + 30 + 4$

Word name	Standard form	Expanded form
	312	
		$600 + 7$

- Have children prepare banners to show the expanded form and the standard form for other numbers.
- Prepare 27 cards, one for each of the numerals 1 to 9, the multiples of ten to 90, and the multiples of one hundred to 900. The tens' cards should be twice as long as the ones' cards; the hundreds' cards should be three times as long as the ones' cards. Have children show the expanded form and the standard form for numbers using the appropriate cards. These cards may be used again in Unit 11.

300	50	6	3	5	6
-----	----	---	---	---	---

- Use cards similar to these for the game "Concentration" on page T 349.

$600 + 20 + 2$	622
----------------	-----

- Use cards similar to these for the game "Dominoes" on page T 349.

$400 + 3$	517	$500 + 10 + 7$	208
-----------	-----	----------------	-----

Working Together: These exercises examine the objective in two ways. The standard form for a number is given and the children are asked to write the expanded form. Then the procedure is reversed. Note that some exercises show 0 tens or 0 ones.

Exercises: If children have difficulty with any of the word names in Ex. 17-28, encourage them to write the standard form first.

Try This: The concept of one hundred is reinforced by this puzzle. Explain what is meant by a diagonal move. Let the children use a trial-and-error approach to the solution. (This may be done more easily on a cardboard copy covered with acetate.) You may show the puzzle on copies of page T 360 and number every square in the path in order, for the children to compare their solutions or to help children who may have difficulty. Some children may prefer a smaller version of the puzzle, such as a five-by-five array of twenty-five squares. Many variations are possible by

choosing new positions for the first and last squares in a path. Although there may be many solutions for one puzzle, there are also puzzles with no solution, as in the second puzzle on the page. You can test this by joining the two designated squares with any short path (no diagonal moves). If the number of moves in the path and the number of squares in the puzzle are both even or both odd, there is no solution.

Assessment

Write in standard form.

1. $400 + 6$ 406
2. $100 + 80 + 7$ 187

Write in expanded form.

3. nine hundred thirty $900 + 30$

Write the words.

4. $200 + 10 + 5$ two hundred fifteen

LESSON OUTCOME

Regroup with numbers to 999

Materials

models for hundreds, tens, and ones

Vocabulary

regroup

Prerequisite Skills

Interpret place value in numerals to 999

Checking Prerequisite Skills

Complete the following.

- 412 = 4 hundreds 1 tens
2 ones
- 310 = 3 hundreds 1 tens
0 ones
- 5 hundreds 0 tens 8 ones = 508
- 2 hundreds 0 tens 0 ones = 200

Background

The exercises in this lesson enable the child to practice the kind of regrouping that will be performed in addition and subtraction exercises in Units 3 and 5.

Regrouping

A number can be shown many ways.
Here are some ways to show 138.



Working Together

Regroup and show each number in standard form.

- ⁴⁴⁵
1.

hundreds	tens	ones
4	3	15
- ⁸⁴⁸
2.

hundreds	tens	ones
7	14	8
- ⁴⁴⁷
3.

hundreds	tens	ones
3	13	17

Regroup to show 10 more ones.

Examples: For 625, show ¹¹⁵~~625~~.

For 407, think ³⁹¹⁷40 tens, 7 ones, and show ~~407~~.

- ⁶¹²
4. ~~572~~
- ⁸⁹¹⁶
5. ~~306~~
- ¹⁸¹⁰
6. ~~209~~

Regroup to show 10 more tens.

- ⁷¹⁵
7. ~~882~~
- ¹¹⁸
8. ~~204~~
- ¹¹⁰
9. ~~100~~

Regroup to show 10 more ones.

Then regroup to show 10 more tens.

Example: For 625, show ¹¹⁵~~625~~. Then show ⁵⁷¹⁵~~625~~.

- ¹²
10.

736
736
- ¹⁰¹⁴
11.

214
214
- ⁰¹¹⁰
12.

120
120

LESSON ACTIVITY

Before Using the Pages

- Show the following chart on the board.

	hundreds	tens	ones	
1.		4	3	?
2.	1	2	6	?
3.	?	?	?	527
4.	4	0	2	?
5.	?	?	?	280

For each exercise, have the children use their models to show the hundreds, tens, and ones, and write the missing information on the board. Each child would benefit from reading one completed exercise aloud; for example, "Four hundreds zero tens two ones is four hundred two". (Note that the word *and* is not used in naming the number.)

- Use models for hundreds, tens, and ones to represent the same number in different ways. Begin with a number less than

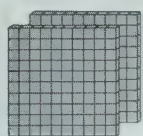
one hundred, for example, twenty-seven. Have the children show 2 tens and 7 ones. Ask them to show twenty-seven using only one ten, and then again using zero tens. After each form for the number is shown with the models, write the numerals on a chart similar to those on page 8 showing hundreds, tens, and ones. Then repeat the procedure for numbers to 999. Have the children verbalize their action; for example, "If you are allowed only 1 ten, you have to take out one of the tens and put in 10 more ones."

Reverse the procedure for one or two exercises. For example, have the children set out 2 hundreds, 17 tens, and 10 ones, and have them show the standard form for the number represented.

Using the Pages

- The illustrations at the top of each page suggest the standard form for a number and show three other forms for expressing the number. Ask the children how they can tell which gives the standard form. Lead them to realize that the digit in any place is not greater than 9.

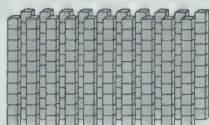
Here are some ways to show 204.



2 hundreds



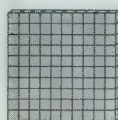
4 ones



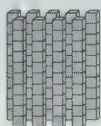
20 tens



4 ones



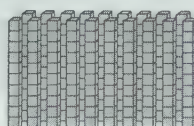
1 hundred



9 tens



14 ones



19 tens



14 ones

Exercises

Write each number in standard form.

1.

hundreds	tens	ones
553	5	4 13
2.

hundreds	tens	ones
707	6	10 7
3.

hundreds	tens	ones
208	1	9 18
4.

hundreds	tens	ones
624	5	11 14
5.

hundreds	tens	ones
560	4	16 0
6.

hundreds	tens	ones
960	8	15 10

Regroup to show 10 more ones.

7.

hundreds	tens	ones
534	2 14	
8.

hundreds	tens	ones
401	39 11	
9.

hundreds	tens	ones
650	4 10	
10.

hundreds	tens	ones
103	9 13	
11.

hundreds	tens	ones
212	0 12	
12.

hundreds	tens	ones
305	29 15	

Regroup to show 10 more tens.

13.

hundreds	tens	ones
349	2 14	
14.

hundreds	tens	ones
170	0 17	
15.

hundreds	tens	ones
805	7 10	
16.

hundreds	tens	ones
267	1 16	
17.

hundreds	tens	ones
508	4 10	
18.

hundreds	tens	ones
756	6 15	

Regroup to show 10 more ones.

Then regroup to show 10 more tens.

19.

hundreds	tens	ones
485	3 15	
20.

hundreds	tens	ones
860	7 10	
21.

hundreds	tens	ones
613	5 13	
22.

hundreds	tens	ones
192	0 12	
23.

hundreds	tens	ones
840	8 10	
24.

hundreds	tens	ones
771	6 11	

31

RELATED ACTIVITIES

- Some children may like to make graph-paper cutouts of hundreds, tens, and ones and use these to make a display showing different ways to represent one number.
- A work sheet similar to the following could be used.

Match names for the same number.

	hundreds	tens	ones
246	0	20	3
442	1	14	6
203	3	13	12
186	1	9	10

- Challenge the children to find five different ways of showing one number, such as one hundred fifty-two. If the children's results are shown in a chart on the board, you will likely end up with more than five ways.

Introduce the word *regroup*. Use the word to describe the change that occurs from one form for the number to another. For example, begin with the illustration of 2 hundreds 4 ones and move in a clockwise direction: 2 hundreds are regrouped as 20 tens; 1 ten is regrouped as 10 more ones; and finally 1 hundred is regrouped as 10 tens. You may wish to have the children use their own models to represent these and other forms for the numbers.

Working Together: Ex. 1-3 involve the type of regrouping encountered in addition. In Ex. 1, have the children regroup the ones first and then the tens since it is approached in this order in addition. Show them how to record their answers in the following manner.

hundreds	tens	ones	
	4	5	
4	3	15	445

Use other similar examples with one and two regroupings.

The regrouping in Ex. 4-12 relates to subtraction. The skill is approached in three stages: regrouping from tens to

ones (Ex. 4-6); regrouping from hundreds to tens (Ex. 7-9); two regroupings for each number (Ex. 10-12). Provide more examples of each stage as required. If necessary, use models.

Exercises: Encourage the children to space their written answers allowing sufficient space to show the regrouping. You may wish to have the children rule columns for hundreds, tens, and ones for Ex. 7-24.

Assessment

Write in standard form.

1.

hundreds	tens	ones
1	6	15 175
2.

hundreds	tens	ones
2	12	14 334

Regroup.

3. Show 10 more ones for 302.

hundreds	tens	ones
	29 12	302
4. Show 10 more tens for 813.

hundreds	tens	ones
	7 11	813
5. Show 10 more ones, and then show 10 more tens for 250.

hundreds	tens	ones
	4 10	250

hundreds	tens	ones
1	10	250

LESSON OUTCOME

Compare and order numbers to 999; recognize and use the symbols $>$ and $<$ for "is greater than" and "is less than"

Materials

flash cards for "is greater than", "is less than", and the symbols $>$ and $<$; one numeral card for a number less than 10 for each child

Vocabulary

least, greatest

Prerequisite Skills

Read and write standard numerals for numbers to 999; interpret place value for three-digit numerals

Checking Prerequisite Skills

Write the standard numeral.

1. two hundred sixty-seven 267

2. eight hundred four 804

Complete the following.

3. $640 = \underline{6}$ hundreds $\underline{4}$ tens
 $\underline{0}$ ones

4. 3 hundreds 1 ten 6 ones = 316

Comparing and Ordering Numbers

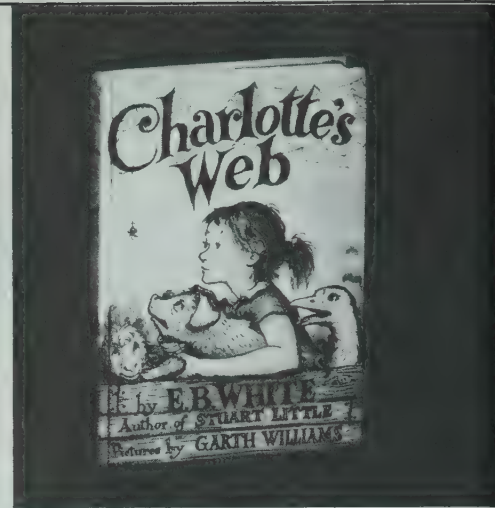
Charlotte's Web has 184 pages.
There are 162 pages in
Charlie and the Chocolate Factory.
Which book has more pages?

First, look at the hundreds place.
184 shows 1 hundred.
162 shows 1 hundred.

Next, look at the tens place.
184 shows 8 tens.
162 shows 6 tens.

8 is greater than 6, so
184 is greater than 162.

Charlotte's Web has more pages.



$$184 > 162$$

The $>$ stands for is greater than.

Working Together

Where are the digits first different—in the hundreds, tens, or ones place?

1. ones place	2. hundreds place
455	386
459	586

Use $>$ or $<$ to show which is greater or which is less.

Example: $173 < 221$ shows 173 is less than 221.

7. $762 \bigcirc 739$ $>$

8. $225 \bigcirc 86$ $>$

9. $550 \bigcirc 553$ $<$

Show each group of numbers in order from least to greatest.

10. <div>157 75 175</div>	11. <div>277 222 272</div>	12. <div>434 444 343</div>
<div>75 157 175</div>	<div>222 272 277</div>	<div>343 434 444</div>

32

Give the numbers between

13. 30 and 40. 14. 177 and 185.

15. 508 and 521. 16. 96 and 110.

13. 31, 32, 33, 34, 35, 36, 37, 38, 39.

14. 178, 179, 180, 181, 182, 183, 184.

15. 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520.

16. 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109.

LESSON ACTIVITY

Before Using the Pages

- As a warm-up activity, have the children rote count, for example, from eight hundred ninety-six to nine hundred five.
- Ask questions such as, "What number comes before (after) two hundred? between six hundred seventy-nine and six hundred eighty-one?"
- Review the symbols $>$ and $<$ for *is greater than* and *is less than*. Write these statements on the board:
_____ is less than _____. _____ is greater than _____.
Have children name numbers to complete the statements. Then replace each phrase with the appropriate symbol. Have children suggest ways for remembering each symbol. They may say that one always points to the smaller number, or that it "opens up" toward the greater number. Ensure that each number sentence is read from left to right. Display cards showing the symbols and words for several days.

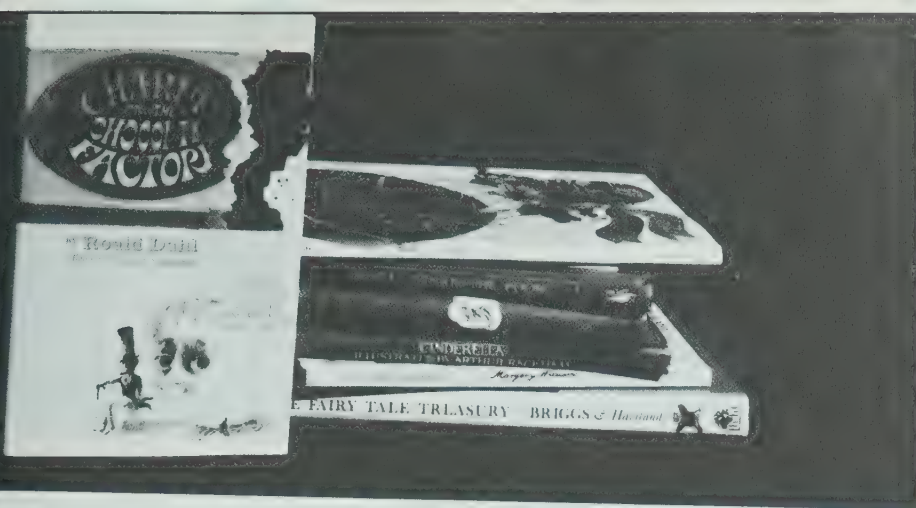
- Compare two numbers not greater than 999 by using the simple game. Each child needs one numeral card for a number less than ten. Designate place holders on the board for two three-place numerals as shown.

Have two children place their cards in the ones' place. Ask if they can tell which three-digit number is going to be the greater one. Repeat this procedure for the tens' place and then for the hundreds' places. Children quickly realize that it is questionable which number will be the greater until the hundreds' places are filled.

Ask the children if they can think of a different way of comparing two numbers.

Using the Pages

- Use the example at the top of page 32 to lead the children through the steps of comparing two numbers by examining the digits from left to right.



Exercises

Which book has more pages?

1. 372 pages 273 pages

2. 443 pages 434 pages

3. 268 pages 282 pages

Copy the greater number.

4. 59 or 502 5. 819 or 891
6. 429 or 427 7. 708 or 608

Write $<$ or $>$ to make a true statement.

8. $323 \bigcirc 329 <$ 9. $753 \bigcirc 733 >$
10. $369 \bigcirc 669 <$ 11. $968 \bigcirc 908 >$
12. $519 \bigcirc 512 >$ 13. $407 \bigcirc 708 <$

List the numbers in order from least to greatest.

14.

332
223
323
232
322
233

 15.

411	140
110	441
404	114
41	141
414	401
104	144

List the numbers between

16. 556 and 565. 17. 194 and 212.

14. 223, 232, 233, 322, 323, 332. 15. 41, 104, 110, 114, 140, 141, 144, 401, 404, 411, 414, 441.
16. 557, 558, 559, 560, 561, 562, 563, 564. 17. 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211.

RELATED ACTIVITIES

• Children may enjoy arranging a set of books in the classroom reading corner according to the number of pages in each book. Ask whether a book that has more pages is always thicker than a book that has fewer pages.

• Three players may play a game using one set of numeral cards for 0 to 9. (Use the cards prepared for the game in the *Lesson Activity*.) Each player should have a pocket chart similar to the one shown. (Library book pockets make suitable card holders for the chart.)

high	9	1	0
	h	t	o
middle			
	h	t	o
low			
	h	t	o



To play the game, the cards are shuffled and three are dealt to each player. The tenth card is set aside face down. Players decide whether the numerals on their cards are best for forming a "high" number, a "middle" number, or a "low" number. Without being observed by their opponents, players place their cards in the appropriate pockets to indicate their choices. Then the charts are displayed. Each player whose number is correctly placed in relation to the other players' numbers scores one point. A winner may be declared after ten rounds or after a player scores ten points.

Assessment

Write $>$ or $<$ to make a true statement.

1. 67 \bigcirc 201 2. 153 \bigcirc 117 3. 475 \bigcirc 470

Write from least to greatest.

4. 735, 537, 573, 375, 753, 357
5. 274, 146, 327, 243, 67, 147

List the numbers between

6. 297 and 311.

4. 357, 375, 537, 573, 735, 753
5. 67, 146, 147, 243, 274, 327

determine whether any of the children are familiar with the books pictured on the page. Have them examine their *Starting Points in Mathematics* book and another book to find the number of pages in each. Write the numerals on the board and examine the digits from left to right. Use other examples as needed. Children soon realize that there is no need to examine the digits in the tens' places unless the digits in the hundreds' places are the same, and no need to examine the digits in the ones' places unless the digits in the tens' places are the same.

Working Together: Ex. 1 and 2 emphasize the left to right order of inspecting the digits. In Ex. 3-6, only the digits 5 and 8 need to be examined in each pair. Prepare a similar set of exercises, if necessary. Ex. 10-12 reinforce the concept that the value of a digit is determined by its position in the numeral.

Exercises: Children may find Ex. 15 easier if they copy all the numerals and then determine the order, crossing out each numeral as it is selected.

OBJECTIVE

Complete number sequences and patterns in number squares

Vocabulary

pattern square

RELATED ACTIVITIES

- Some children may enjoy preparing number sequences or pattern squares for other children to complete. Have them show the answers on the back of the sheet to make the activities self-checking.
- Have children identify numbers that do not fit a given pattern, such as 211, 221, 231, 232, 241.
- Children may print their names in a section of graph paper and show the number patterns. For example, the name KIM shown here reveals a “K” pattern of 1, 4, 7, 10, 13, 16, 19, and an “M” pattern of 3, 6, 9, 12, 15, 18.

(K)	I	M	(K)	I
M	(K)	I	M	(K)
I	M	(K)	I	M
(K)	I	M	(K)	I

Practice

Complete the number patterns.

- 0, 1, 2, 3, 4
- 40, 50, 60, 70, 80
- 300, 400, 500, 600, 700
- 11, 12, 13, 14, 15
- 23, 33, 43, 53, 63
- 547, 647, 747, 874, 974
- 20, 30, 40, 50, 60
- 435, 445, 455, 465, 475
- 228, 328, 428, 528, 628
- 373, 374, 375, 376, 377
- 0, 2, 4, 6, 8, 10, 12, 14, 16, 18
- 1, 3, 5, 7, 9, 11, 13, 15, 17, 19
- 5, 10, 15, 20, 25, 30, 35, 40, 45, 50
- 35, 40, 45, 50, 55, 60, 65, 70, 75, 80
- 25, 50, 75, 100, 125, 150, 175, 200, 225, 250
- 84, 86, 88, 90, 92, 94, 96, 98, 100, 102
- 70, 75, 80, 85, 90, 95, 100, 105, 110, 115

Copy and complete the pattern squares. Show number patterns across and down.

18.

311	312	323
321	322	323
331	332	333

19.

129	229	329
130	230	330
191	231	331

20.

650	680	670
780	780	770
850	880	870

21.

386	486	586
396	496	596
406	506	606

22.

88	98	108
89	99	109
90	100	110

*23.

442	542	642
443	543	643
444	544	644

34

LESSON ACTIVITY

Using the Page

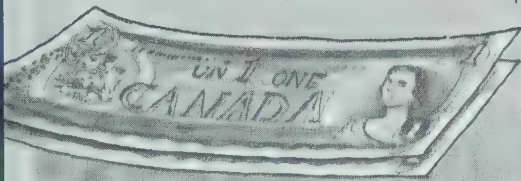
- The number patterns for Ex. 1-17 are restricted to increases of one, two, five, ten, twenty-five, or one hundred. The numbers in the columns and the rows for the pattern squares may increase by one, ten, or one hundred. Ex. 23 is starred since it can be solved in more than one way. It may help to have the children verbalize what two patterns they see in each square.
- Work through one or two examples of pattern squares to help the children understand that there are two patterns for each square — a horizontal one and a vertical one. The following examples may be used.

54	55	?
64	65	?
?	?	?

385	395	?
485	?	505
?	?	?

Naming Amounts of Money

Scrooge has to pay his clerk his wages for the week—two dollars and forty-three cents.



4 dimes 3 pennies 43¢

2 dollars 4 dimes 3 pennies \$2.43
2 dollars and 43 cents

Exercises

Copy and complete each table.

	Dimes	Pennies	Amount
1.	2	7	27¢
2.	4	6	46¢
3.	3 ?	2 ?	32¢
4.	0	3	3¢
5.	6 ?	0 ?	60¢

	Dollars	Dimes	Pennies	Amount
6.	3	1	5	\$3.15
7.	4	2	0	\$4.20
8.	1 ?	7 ?	6 ?	\$1.76
9.	6 ?	0 ?	8 ?	\$6.08
10.	5	2	5	\$5.25

Write each amount using numerals.

11. fifty-two cents 52¢ or \$0.52 12. four dollars and eleven cents \$4.11
13. eighteen cents 18¢ or \$0.18 14. three dollars and ninety-five cents \$3.95

Write each amount using words.

15. 99¢ 16. 2¢ 17. 40¢ 18. 63¢
19. \$4.11 20. \$7.50 21. \$2.09 22. \$0.95
15. ninety-nine cents 16. two cents 17. forty cents 18. sixty-three cents
19. four dollars and eleven cents 20. seven dollars and fifty cents
21. two dollars and nine cents 22. ninety-five cents

35

LESSON OUTCOME

Read and write numerals and words for amounts of money less than ten dollars

Materials

real money, play money, or cutouts from pages T351 and T352

Vocabulary

penny, dime, dollar, amount, cent

Prerequisite Skills

Count by tens and ones

Checking Prerequisite Skills

Write the numerals for counting

1. by tens to 40 and then by ones to 46. 10, 20, 30, 40, 41, 42, 43, 44, 45, 46
2. by tens to 70 and then by ones to 74. 10, 20, 30, 40, 50, 60, 70, 71, 72, 73, 74

Background

Dollars, dimes, and pennies reinforce place values (hundreds, tens, and ones) in our numeration system.

RELATED ACTIVITIES

- A play store set up in the classroom may offer items priced to \$9.99. Have the children choose one item at a time and pay the exact amount shown with dollars, dimes, and pennies. Have the children take turns being storekeeper.

SSON ACTIVITY

Before Using the Page

Display real or play money. Have children identify and state the value of a penny, a dime, and a dollar. Write the words on the board. Review that 10 pennies have the same value as one dime, and that 100 pennies or 10 dimes have the same value as one dollar.

Use dimes and pennies to show amounts of money to 99¢. Have children state the amounts. State amounts of money and have children show the coins.

Represent amounts of money to \$9.99 with dollar bills, dimes, and pennies. Have children state the amounts. Note that the word "and" is used in reading the amount of money.

Write amounts of money on the board and have children show the number of bills and coins needed for each amount. For example,

\$3.52 = _____ dollars _____ dimes _____ pennies.

Then show numbers of bills and coins and have children determine each amount. For example,

2 dollars 6 dimes = \$_____.

Using the Page

- Read the example. Have children identify the symbols ¢ and \$. Write the symbols on the board.
- Have children relate amounts of money involving zero to real or play money.

Exercises: Either ¢ or \$ may be used to write the amounts for Ex. 11 and 13, although most children will use ¢.

Assessment

Complete the following.

1. 3 dimes 7 pennies = 37¢
2. \$6.90 = 6 dollars 9 dimes 0 pennies

Write as a numeral.

3. three dollars and eight cents \$3.08 4. \$0.75
seventy-five cents

Write in words.

LESSON OUTCOME

Read and write words and numerals for fractions less than one (halves, thirds, fourths, tenths)

Materials

4 pieces of circular paper or filter paper for each child, some pictures of shapes that show thirds and some that show tenths, tracing paper

Vocabulary

fraction, names of fractions less than one for halves, thirds, fourths, and tenths

Naming Fractions Less Than 1

Tom tricked his friends into painting the fence.



How much have they painted so far?

4 parts painted.
10 equal parts.

Write $\frac{4}{10}$

So far, they have painted **4 tenths** of the fence.

$\frac{4}{10}$ is a **fraction**. Fractions tell how much of something is special.

Working Together

Which of these show equal parts?

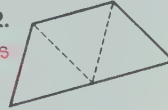
1.

no



2.

yes



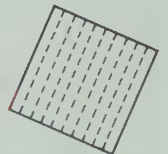
3.

no



4.

yes



How many equal parts in each of these?

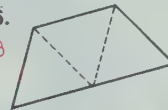
5.

2



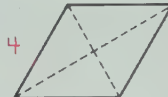
6.

3



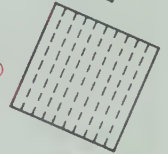
7.

4



8.

10



How many of the equal parts are shaded?

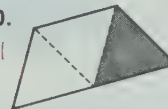
9.

1



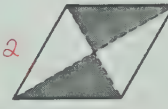
10.

1



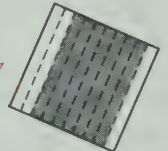
11.

2



12.

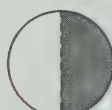
7



Give the fraction that shows how much is shaded.

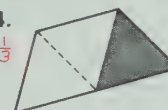
13.

$\frac{1}{2}$



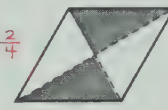
14.

$\frac{1}{3}$



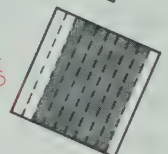
15.

$\frac{2}{4}$



16.

$\frac{7}{10}$



LESSON ACTIVITY

Before Using the Pages

- Introduce halves. Have the children fold a circular piece of paper into two equal parts. Say that since the two parts are equal the shape shows *halves*. Have the children color one half of their shapes. Tell the children that numbers such as one-half are called *fractions*. Write the words *fraction*, *one-half*, and the numeral $\frac{1}{2}$ on the board. Point out that the lower numeral shows the number of equal parts and the upper numeral shows the number of special parts. Have the children write the numeral $\frac{1}{2}$ and the word *one-half* on one of the halves of their shapes.
- Fold a circular piece of paper into two unequal parts. Have the children discuss whether the shape shows halves.

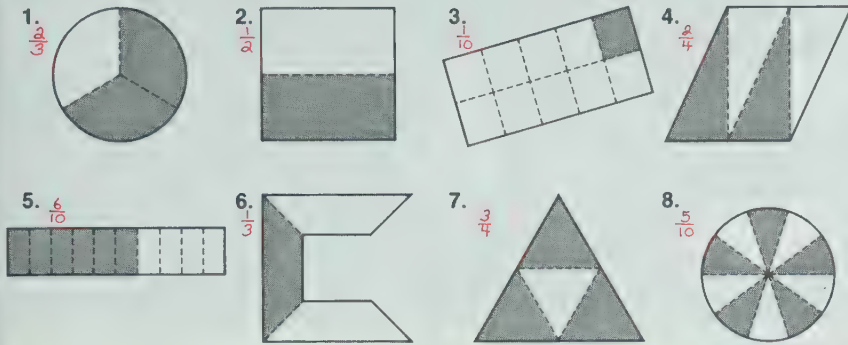
- Adapt the first activity to show fourths. Have each child fold three pieces of circular paper into four equal parts and color one fourth, two fourths, and three fourths. Then have them write the words and the numerals on the colored parts.
- Discuss thirds and tenths. Write the words *thirds* and *tenths* on the board. Ask how many equal parts a shape has in order to show these. Display some pictures of shapes showing thirds and some showing tenths. Have children suggest how to write the numeral and the word for each.

Using the Pages

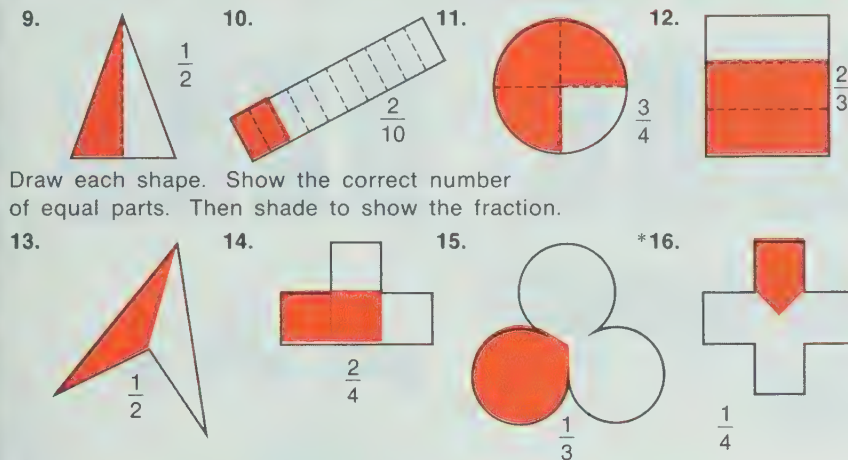
- Tell the story of how Tom Sawyer tricked his friends into whitewashing the fence. Point out that four of the ten equal parts of the fence are whitewashed. Discuss how the fraction $\frac{4}{10}$ shows this. Ask what fraction shows how much of the fence is still green. Have children write the fraction and the word on the board.

Exercises

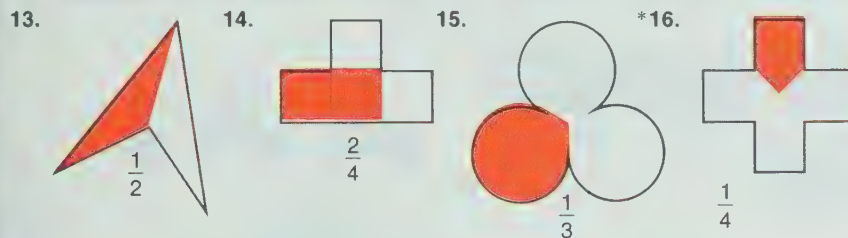
Write the fraction that shows how much is shaded.



Draw each shape. Shade to show the fraction. The choice of shaded parts may vary.



Draw each shape. Show the correct number of equal parts. Then shade to show the fraction.



Write the fraction. Other ways of showing the fractions are possible.

17. three-tenths $\frac{3}{10}$ 18. one-half $\frac{1}{2}$ 19. two-thirds $\frac{2}{3}$ 20. three-fourths $\frac{3}{4}$

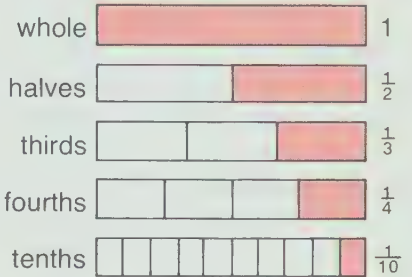
Write the words.

21. $\frac{2}{4}$ two-fourths 22. $\frac{7}{10}$ seven-tenths 23. $\frac{1}{3}$ one-third 24. $\frac{1}{2}$ one-half 25. $\frac{4}{10}$ four-tenths 26. $\frac{1}{4}$ one-fourth

37

RELATED ACTIVITIES

- For extra practice, have the children write fractions for Ex. 1-8 on page 37 to show how much of each shape is white.
- Children may help to make a display showing a whole strip of paper and other identical strips marked to show halves, thirds, fourths, and tenths. The display illustrates that as the number of equal parts of a whole increases, the size of the parts becomes smaller.



Implied in this display is the fact that ten-tenths, four-fourths, three-thirds, and two-halves are all equivalent to one whole.

Working Together: These exercises establish the significance of the upper and lower numerals of a fraction and indicate that it is best to determine the number of equal parts first and then the number of parts that are special. The four sub-skills dealt with are:

- establish whether the shape shows equal parts;
- count the equal parts;
- count the special parts;
- give the fraction.

Some children may need to trace one part of a shape and match it with the others to discover whether the parts are equal. You may wish to have the children write the numerals and words for Ex. 13-16.

Exercises: Provide tracing paper for reproducing the diagrams for Ex. 9-16. Some children may require help in marking the equal parts for Ex. 16.

Assessment

Write the fraction.

1. two-thirds $\frac{2}{3}$

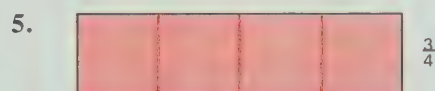
Write in words.

2. $\frac{9}{10}$ nine-tenths

Write the fraction that shows how much is shaded.



Draw the shape. Mark lines. Color to show the fraction.



LESSON OUTCOME

Read and write words and numerals for mixed numbers less than ten for halves, thirds, fourths, and tenths

Materials

display board; 16 circular cutouts the same size, four of which are colored to show halves, thirds, fourths, and tenths, respectively

Vocabulary

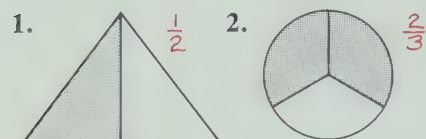
names for mixed numbers less than ten for halves, thirds, fourths, and tenths

Prerequisite Skills

Read and write words and numerals for fractions less than one for halves, thirds, fourths, and tenths

Checking Prerequisite Skills

Write the fraction to show how much is shaded.



Write the fraction.

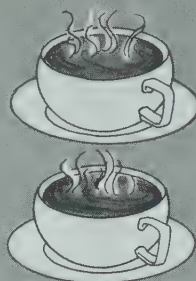
3. seven-tenths $\frac{7}{10}$

Write in words.

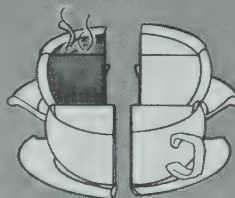
4. $\frac{3}{4}$ three-fourths

Naming Fractions Greater Than 1

Dormouse and the March Hare each had one cup of tea.
The Mad Hatter had one-fourth of a cup of tea.



2 whole cups



1 full part
4 equal parts

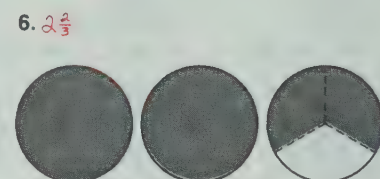
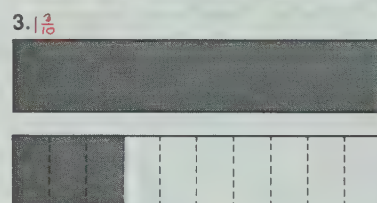
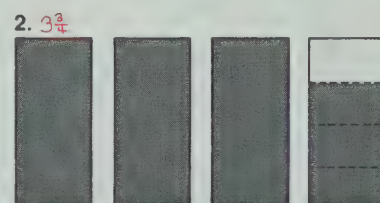
The number

$$2\frac{1}{4}$$

(two and one-fourth)
shows how many
cups of tea in all.

Exercises

Write the number that shows how much is shaded.



LESSON ACTIVITY

Before Using the Pages

- Ask the children about the Queen of Hearts in the book *Alice's Adventures in Wonderland*. Then read the following nursery rhyme.

The Queen of Hearts,
She made some tarts,
All on a summer's day.
The Knave of Hearts,
He stole the tarts,
And took them clean away.

The King of Hearts
Called for the tarts,
And beat the Knave full sore.
The Knave of Hearts
Brought back the tarts,
And vowed he'd steal no more.

Use the display board with cutouts to represent tarts. Name numbers of "tarts" for children to take. Begin with whole numbers. Then name fractions less than one. Finally, name fractions greater than one. Write the numeral and the word on the board for the examples of fractions greater than one.

Using the Pages



- Tell the story of the Mad Hatter's tea party at which two and one-fourth cups of tea were poured. Have the children discuss the example and the manner of showing one-fourth of a cup of tea.



Exercises: Ensure that the children understand the instruction. You might work through one exercise from each section with them.



Some children may express uncertainty about the fractions shown in Ex. 1 and Ex. 5. These children would benefit from paper-folding activities. For Ex. 1 have the child fold a rectangular sheet of paper along a diagonal, cut the paper along the fold, and match the two parts. For Ex. 5

Other ways of showing the fractions are possible.

7. Draw 4  's.
Shade $3\frac{2}{3}$ 

8. Draw 2  's.
Shade $1\frac{3}{4}$ 

9. Draw 3  's.
Shade $2\frac{1}{2}$ 

10. Draw 2  's.
Shade $1\frac{1}{3}$ 

Write the numbers.

11. two and one-fourth $2\frac{1}{4}$
12. five and six-tenths $5\frac{6}{10}$
13. one and two-fourths $1\frac{2}{4}$
14. seven and nine-tenths $7\frac{9}{10}$
15. three and one-third $3\frac{1}{3}$
16. eight and one-half $8\frac{1}{2}$

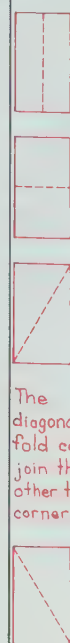
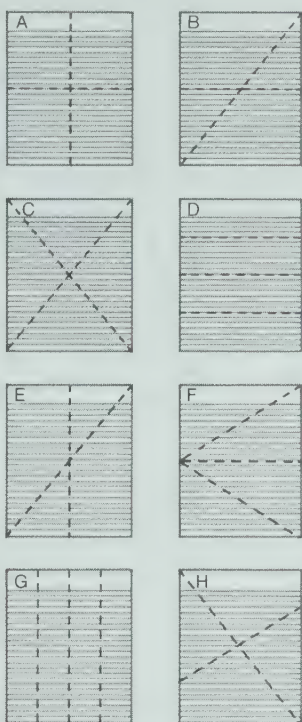
Write the words.

17. $1\frac{2}{3}$
18. $4\frac{2}{10}$
19. $3\frac{5}{10}$
20. $9\frac{1}{2}$
21. $6\frac{3}{4}$
22. $2\frac{1}{10}$



7. one and two-thirds
18. four and two-tenths
19. three and five-tenths
10. nine and one-half
21. six and three-fourths
22. two and one-tenth

1. Can you show 3 ways to fold a sheet of paper in half?
The sheets of paper below were folded two times each.



The diagonal fold could join the other two corners.

Which sheets were

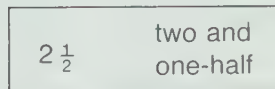
2. folded in half, unfolded, then folded in half again?
A, B, C, E
3. folded in half, then folded in half again without unfolding?
A, D, F, G, H



RELATED ACTIVITIES

• Four players may play the following game.

Materials: forty fraction cards (twenty picture cards and twenty matching numeral cards)



Rules:

1. Shuffle the cards and deal five to each player. Place the rest in a pile.
 2. Players take turns drawing the top card from the pile and examining their cards for matching pairs. These are shown to the other players and then placed face down.
 3. If two cards are incorrectly paired, the next player has a turn.
 4. The game ends when all the cards have been drawn from the pile.
 5. The player with the most matching pairs is the winner.
- Matching cards used in the above game may be clipped back to back and used as flash cards by children working in pairs. A child showing the picture to a partner sees the answer and decides if the partner's answer is correct.

each child needs a triangular piece of paper cut from a square piece along a diagonal. The triangular piece can be folded over twice to form four matching triangular parts.

Note that for Ex. 8-10, there is more than one way of dividing the shape.

This: Provide each child with several rectangular sheets of paper. Some children may find it easier to use a straight edge to draw a diagonal line before folding along a diagonal of a rectangle as for sheet B. Have the children demonstrate and discuss their solutions. Many children will discover that the lines for sheet A can be obtained either way.

Assessment

Write the numeral.

1. seven and three-tenths $7\frac{3}{10}$

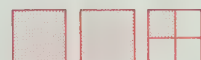
Write in words.

2. $5\frac{2}{3}$ five and two-thirds

3. Write the fraction to show how much is shaded.



4. Draw three  's. Color $2\frac{1}{4}$.



LESSON OUTCOME

Read and write numerals and words for ordinal numbers to *thirty-first* and use these numbers to identify positions

Vocabulary

day, week, month, year, names of the ordinal numbers to *thirty-first*, names of the months of the year, and the days of the week

Prerequisite Skills

Understand ordinal numbers to *tenth*

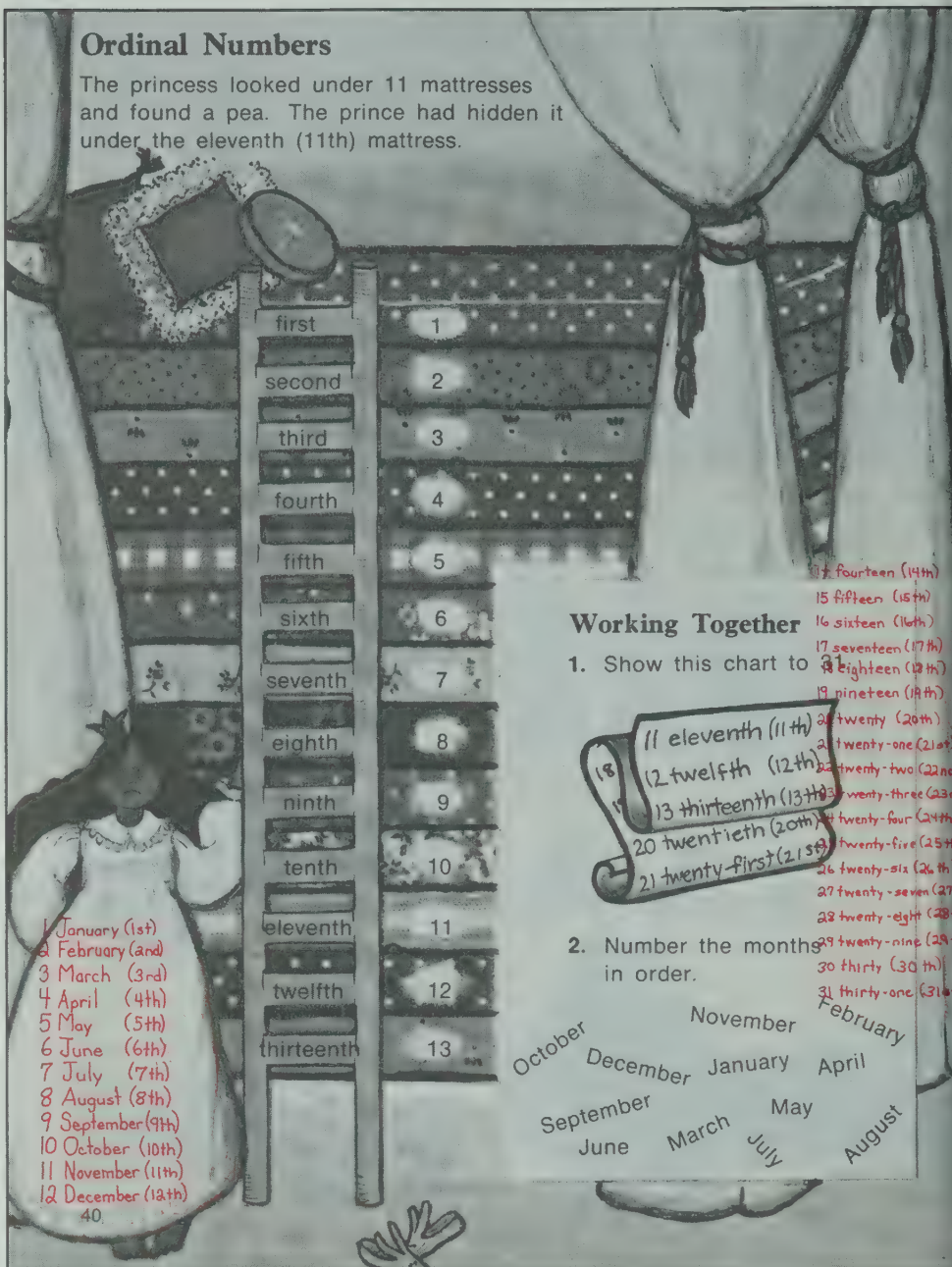
Checking Prerequisite Skills

For the word PAINTBRUSH,

1. the fifth letter is T.
2. the second letter is A.
3. the seventh letter is R.

Background

A cardinal number (one, two, three, . . .) tells how many, and an ordinal number (first, second, third, . . .) tells which one. A cardinal number is found by starting to count with any member of the group. An ordinal number, however, is found by beginning with a particular member and counting in a certain direction.

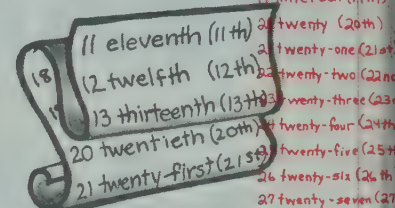


Ordinal Numbers

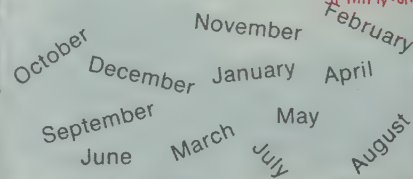
The princess looked under 11 mattresses and found a pea. The prince had hidden it under the eleventh (11th) mattress.

Working Together

1. Show this chart to



2. Number the months in order.



LESSON ACTIVITY

Before Using the Pages

- Explore ordinal numbers. Have the children line up in a row as you call their names in turn and say the ordinal numbers to indicate their positions.

Have each child in turn step forward and state her/his position in the row. Then repeat the procedure with the order of the row reversed so that the last child becomes the first. Emphasize that order depends upon what is agreed to be first.

To have the children return to their desks, call a child's name. Have that child state her/his ordinal number as she/he leaves the row.

Using the Pages

- Tell the story *The Princess and the Pea*. Read the information at the top of the page. Then ask questions similar to the following.
 - “Under which mattress would you hide the pea?”
 - “What color is the twelfth mattress?”
 - “Which mattresses are green?”
- Discuss similarities and differences between the ordinal names on the rungs of the ladder and the corresponding cardinal names. For example, *one* and *first* are different, the *ve* in *five* changes to *f* before adding the suffix, and *six* is changed before adding the suffix.
- Write the words and the numerals for the ordinal numbers from *first* to *fifth* on the board. Underline the ordinal ending for each word. Show how the endings are used to write the numerals for these numbers. Then name several other ordinal numbers and have the children write the numerals.

Exercises

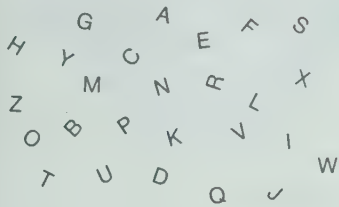
Write a new sentence.
Replace "first" with "second".
Make the other changes needed.

1. January is the first month of the year. February is the second month of the year.
Write a sentence about what comes next.

2. Tuesday is the third day of the week. Wednesday is the fourth day of the week.
Write a sentence about what came before.

3. Lucy reached second base. Lucy reached first base.

4. Number the letters of the alphabet in order.



5. Sunday is the first day of the week. Monday is the second day of the week.

6. Frank had his eighth birthday this year. Frank will have his ninth birthday next year.

7. Friday is the sixth day of the week. Thursday is the fifth day of the week.
Write using numerals.

8. twentieth 20th

9. fifteenth 15th

10. thirty-first 31st

Write the words.

11. 12th twelfth

12. 22nd twenty-second

13. 33rd thirty-third

- 1 A (1st)
- 2 B (2nd)
- 3 C (3rd)
- 4 D (4th)
- 5 E (5th)
- 6 F (6th)
- 7 G (7th)
- 8 H (8th)
- 9 I (9th)
- 10 J (10th)
- 11 K (11th)
- 12 L (12th)
- 13 M (13th)
- 14 N (14th)
- 15 O (15th)
- 16 P (16th)
- 17 Q (17th)
- 18 R (18th)
- 19 S (19th)
- 20 T (20th)
- 21 U (21st)
- 22 V (22nd)
- 23 W (23rd)
- 24 X (24th)
- 25 Y (25th)
- 26 Z (26th)

RELATED ACTIVITIES

- When the children are lined up, have them state in turn the name of their position in the line.
- Have the children list the birthdays of friends in the following three ways: May 25, May 25th, the twenty-fifth of May.
- You may wish to have each child keep a diary. Each day they would record the date and important events. This activity not only reinforces the sequence of the days of the week and the months of the year, but also encourages correct spelling and develops creative writing skills. Once the children understand the daily procedure, encourage them to record what is of interest to them.
- Children can cut out or color pictures of clowns, animals, or members of a marching band, and display them as a "circus parade". Children can identify the ordinal number of the members in the parade. The order of the pictures can be changed. You may wish to show the ordinal numeral and/or word name beneath each picture.

Some or all of these bars can be colored to show the digits from zero to nine.



Here's how to color the bars to show 2.



Draw 10 of these on a sheet of paper.



Color some or all of the bars to show the numbers from 0 to 9.



try this

41

Working Together: These exercises enable the children to write words and numerals for ordinal numbers to *thirty-first*, and to assign ordinal names to show positions. Point out that for the words *twenty* and *thirty*, the *y* changes to *i*, and *eth* is added to form the ordinal numbers.

Ask how many months there are in a year. Have the children say the months in order. For Ex. 2, have the children write 1st to 12th for the names of the months.

Exercises: Review the names of the days of the week and the fact that Sunday is the first day of the week. For Ex. 7, have the children number the letters of the alphabet, using 1st, 2nd, and so on.

Activity: Children may be able to suggest where they have seen numerals similar to those in the photograph. Examples are certain cash registers, scales, digital clocks and watches, as well as calculating machines.

Assessment

Write the numerals.

1. twenty-first 21st 2. eighteenth 18th

Write the words.

3. 20th twentieth 4. 23rd twenty-third

5. What is the fifteenth letter of the alphabet? O

6. Which month of the year is September? ninth

LESSON OUTCOME

Use a calendar to identify dates

Materials

several calendars for the current year, two copies of page T353 for each child, old calendars or a copy of a *World Almanac*

Vocabulary

date, calendar, yesterday, today, tomorrow, leap year

Prerequisite Skills

Name the months of the year and the days of the week in sequence

Checking Prerequisite Skills

Complete each of the following.

1. Each year has 12 months.
2. The fifth month is May.
3. After February is March.
4. The month before November is October.
5. Each week has 7 days.
6. The first day of the week is Sunday.
7. Friday is the sixth day.

Using a Calendar

A calendar page shows

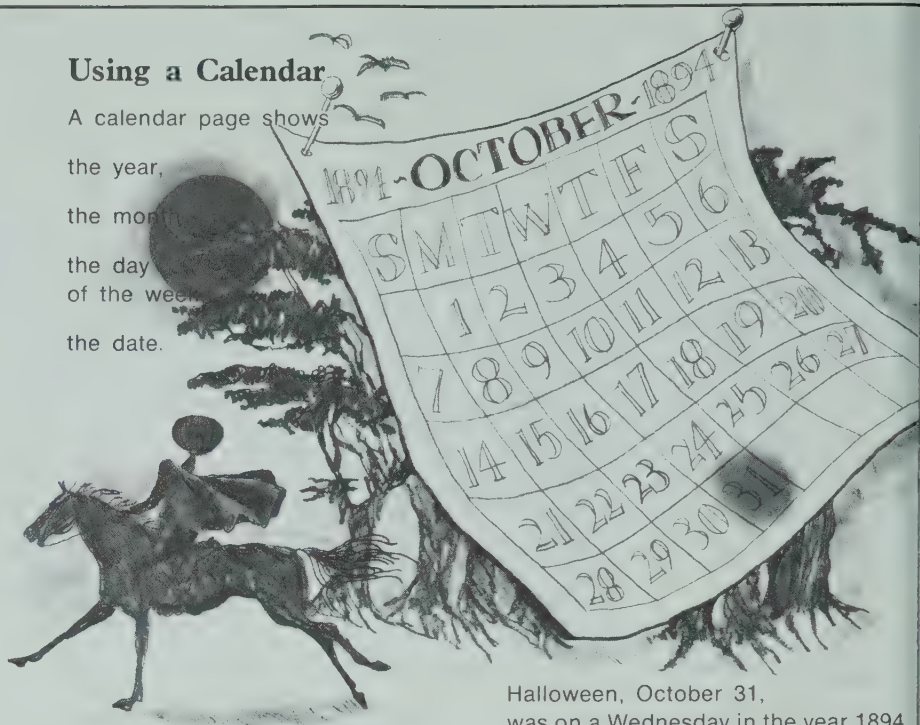
the year,

the month,

the day,

of the week,

the date.



Halloween, October 31, was on a Wednesday in the year 1894.

Working Together

Answers will depend on the year.

Look at the calendar in your room.

1. What year is it?
2. What month is it?
3. What day of the week is it?
4. What is today's date?
5. Which day is the twenty-seventh (27th)?
6. What is the date of the third Tuesday?
7. What is the date one week from tomorrow?

Exercises

Use the calendar page for this month.

1. What day is tomorrow?
2. What is tomorrow's date?
3. What day was yesterday?
4. What was yesterday's date?
5. How many Wednesdays are there?
6. How many Saturdays are there?
7. Which day is the seventeenth (17th)?
8. Write the date of the second Friday.

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LESSON ACTIVITY

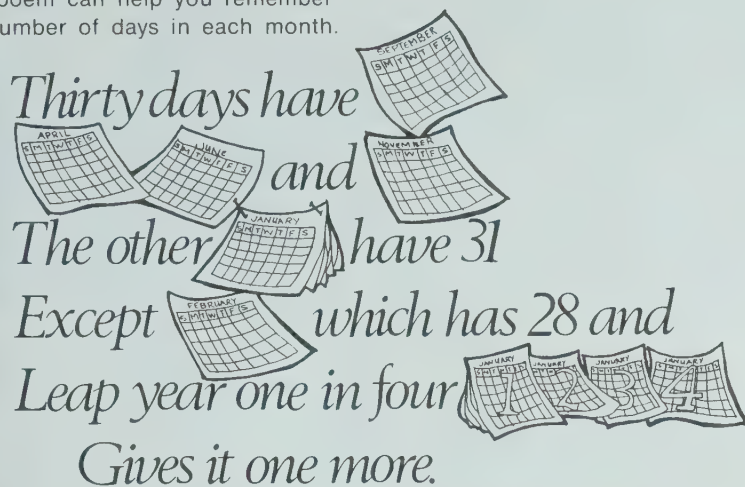
Before Using the Pages

- Have a child name the year of her/his birth. Write the numeral on the board. Ask what year came before and what year came after that year. Write these numerals on the board. Name examples of other years and have children write the numerals. Note that for the present, numerals are read without reference to thousands or hundreds. For example, 1969 is read "nineteen sixty-nine".
- Have several children tell when they were born. Record this on the board in a chart with a column for each of the following: the child's name, the day of the week, the date, the month, and the year. Discuss the meaning of "day", "month", "date", and "year". (A child's day of birth may be determined from an old calendar or a *World Almanac*.)

Using the Pages

- Give the children an opportunity to read the statements and below the picture of the calendar. Then ask questions similar to these:
 "What year is shown?"
 "What month is shown?"
 "What special day is shown?"
 "What day of the week was it?"
 "How many days were Mondays?"
 "What was the date of the second Saturday?"
 "What was the date one week later?"
 "What day of the week was the sixteenth?"
 "What day was the first of November?"
- Ask whether all months have the same number of days. read the poem on page 43. Explain the term *leap year*.
- Discuss calendars. Consider the forms they take (desk, where they are seen (at home, at school, at a bank) people use calendars, and what life would be like without calendars.

calendar for the year shows
 e 12 months of the year.
 is poem can help you remember
 e number of days in each month.



se the calendar for this year. *Answers will depend on the year.*

- | | |
|---|--|
| 9. What month comes next? | 10. What month just passed? |
| 1. What day was it one week ago? | 12. What was the date one week ago? |
| 3. What day will it be in four weeks? | 14. What will be the date in four weeks? |
| 5. Name your favorite day (Sunday, or Monday, or Tuesday, and so on). | 16. Count the number of times your favorite day is the first day of a month. |
| 7. Name your favorite month. | 18. How many days are in your favorite month? |

Draw a calendar page of your favorite month.
 Show your favorite day as the first day.
 Then answer these questions.

- | | |
|--|----------------------------|
| 19. On your calendar page, what day is the fifteenth (15th)? | 21. the tenth (10th)? |
| 20. the twenty-third (23rd)? | 23. the nineteenth (19th)? |
| 22. the fourth (4th)? | 25. the seventh (7th)? |
| 24. the twenty-seventh (27th)? | |

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RELATED ACTIVITIES

- Each morning, assign a child to write the complete date on the board as follows: Monday, September 22, 1980. Ensure that each child has several turns during the year.
- During the year, children may wish to record the weather for each day on a copy of page T 353.
- Although many children may have made birthday graphs in the past, a repetition of the experience is interesting in a new class and provides another example of a graph. Have each child mark a tally on the board beside the name of the month of her/his birthday. Have them prepare a bar graph to display the information. Discuss the results.
- Have groups of three children play the game "Give Me a Clue" described on page T 349. They could help to prepare the name cards required for the game.

Working Together: These questions help the children learn to use a calendar to identify dates. Have each child use a copy of page T 353 to prepare her/his own copy of a calendar for the current month showing the year, the month, the dates, and the days of the week. Some children may require help with spelling. Discuss where to show 1 for the first day of the month and the number of days in the month. You may wish to lead a discussion of the exercises or have the children write their answers. Provide similar exercises.

Exercises: Have the children refer to their own calendars for answering Ex. 1-8. For Ex. 9-18, the children need copies of the calendar for the current year. If the number of calendars is limited, have the children share a calendar. Or some children could prepare their calendars for Ex. 19-25 using copies of page T 353 while others work on Ex. 9-18.

Assessment

You may use a calendar to answer these.

1. How many days has July? *31*
2. What day is the third of October this year? *Answers will depend on the year.*
3. What is the day and the date two weeks from October 3?
4. Give the day, the month, and the date one week before October 3.

LESSON OUTCOME

Show times and write numerals and words for times at five-minute marks

Materials

a paper plate, a short and a long cardboard hand, and a pronged metal fastener for each child; a real dial clock or a demonstration clock face; a digital clock (optional); a copy of page T 354 for each child

Vocabulary

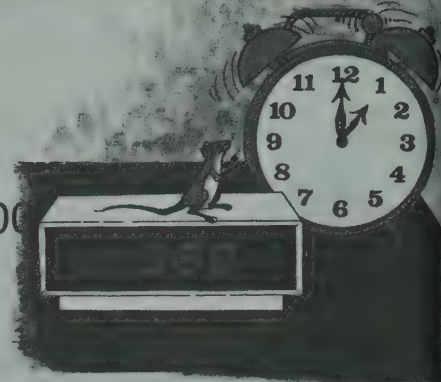
dial clock, digital clock, o'clock, minute hand, hour hand, words for times at five-minute marks

Reading a Clock

The **dial clock** and the **digital clock** both show the same time.

The time is one o'clock.

The time can be shown like this 1:00



Working Together

On a dial clock, the short hand shows the hour. The long hand shows the minutes. The marks along the edge are the minute marks.

How many minutes does it take for the minute hand to move



1. from one mark to the next? 1
2. from one numeral to the next? 5
3. one time around the clock? 60

To tell the time, read the hour, then read the number of minutes.

The hour hand has just passed 8. The minute hand shows 20 minutes. The time is 8:20 (eight twenty).

These two clocks show the same time. What time is it?

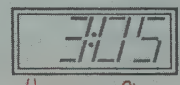

Show this time on a digital clock. Write the time in words.



4.  10:25 or ten twenty-five 

5.  twelve fifty 

Show the time on a dial clock. Write the time in words.

What time is it?

6.  three-o-five 

7.  6:15 or six fifteen  4:40 or four forty

44

LESSON ACTIVITY

Before Using the Pages

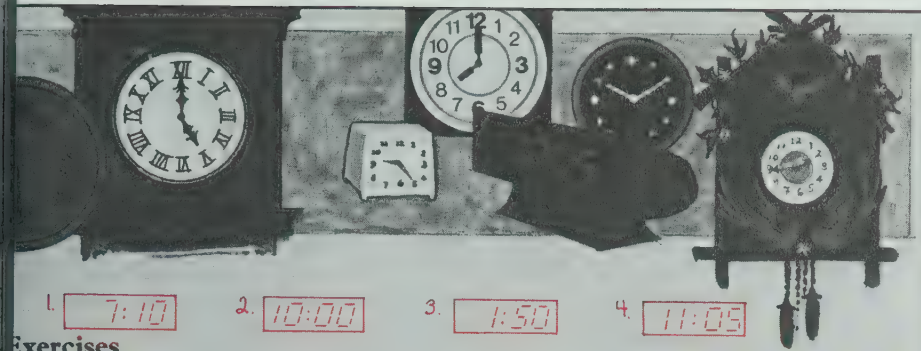
- Before this lesson, have the children make their own clock faces. This can be done one or two days earlier. Give each child a paper plate, cardboard hands, and a fastener described under *Materials*. Have them mark the numerals 1 to 12 on the paper plate and attach the hands to the clock face with the fastener.
- Have the children observe the classroom clock. Ask how the two hands are different. (The second hand need not be discussed at this time.) Review that the short hand is called the *hour hand* and the long hand is called the *minute hand*.
- Review telling time to the hour. Show a time using a demonstration clock. Have the children say the time. Then have children write the numeral and the word for the time on the board. Repeat several times.

- Review showing times to the hour. Name a time. Have children show the time on their paper-plate clock face. Hold them up for you to check. Review that the minute hand always points to 12 for these times. Repeat for different times.

Using the Pages

- Read the example at the top of page 44. Have a child say a rhyme, *Hickory, Dickory, Dock*. Ask whether any children have digital clocks at home. If possible, show a digital clock. Otherwise, have a child explain how a time in minutes is shown on a digital clock.

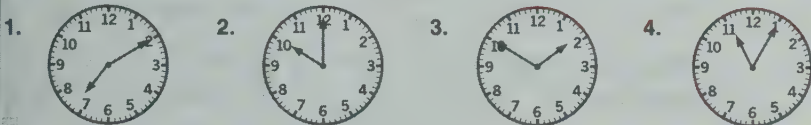
Working Together: Ex. 1-3 establish that numerals on a clock are placed at five-minute marks. Have the children show the minute marks on their paper-plate clock face. Write the numerals for the multiples of five to 60 around the rim. This will help them to read and show times at five-minute marks and later, in Unit 6, to the minute.



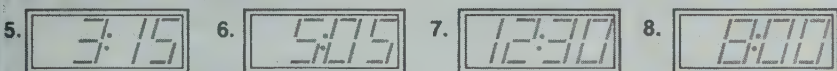
1. 7:10 2. 10:00 3. 1:50 4. 11:05

Exercises

Draw digital clocks to show these times.

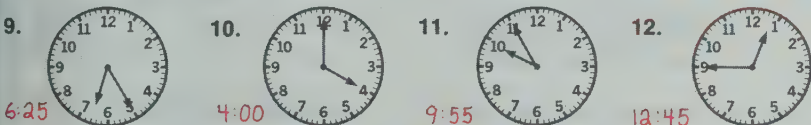
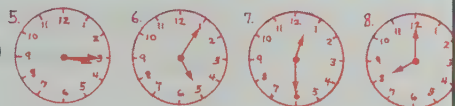


Draw dial clocks to show these times.




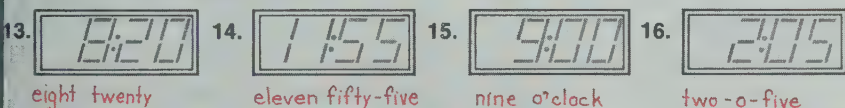
Write the time using numerals.

Example: For  write 3:40



Write the time using words.

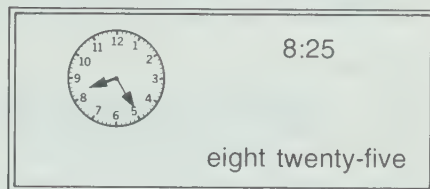
Example: For  write seven thirty-five



45

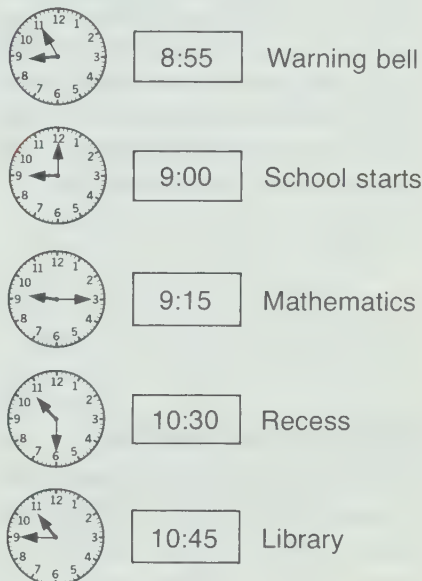
RELATED ACTIVITIES

• Adapt the rules for the game "Give Me a Clue" on page T 349. Prepare a set of time cards similar to this one.



The clues would describe the positions of the two hands for the clock shown on the card. For example, "The hour hand has just passed 8. The minute hand is at the 5. What time is it?"

• Have children help to prepare a chart displaying times of events during the day. Children may enjoy using it as a reference for the day's events.

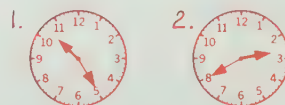


Assessment

Show the time on a dial clock.

1. 10:25

2. 2:40



Write the time using words.

3. 4:05 four-o-five 4. 8:00 eight o'clock

Write the time using numerals.

5.

6.



8:30



6:55

Discuss the steps given for telling the time from a dial clock. Write the following sentences suggesting these steps in the board. Have the children complete the sentences orally when reading dial clocks.

- The hour hand has just passed ____.
- The minute hand shows ____ minutes.
- The time is ____.

Ex. 4-8 may be completed using any combination of answering orally, giving written answers, and/or showing times on paper-plate clock faces. Have children read the times shown on the clocks illustrated at the top of page 45.

You may wish to discuss how the terms *quarter* and *half* can be used to name times, for example, "a quarter past eight" for 8:15 and "half past eight" for 8:30.

ises: Have the children show their answers for Ex. 1-8 on copy of page T 354.

OBJECTIVE

Solve certain word problems without using numbers

Materials

objects referred to on page 46 (optional), balance scales (optional)

Vocabulary

taller, heavier, younger, farther, colder, larger, faster, deeper, equal, equally, shortest, longest

Background

On page 24, the poem emphasizes the application of numbers and their importance in everyday life. The problems on page 46, however, show that many problems can be solved without numbers. Solutions are often determined visually (if the objects concerned are aligned) by matching one to one, by using scales, by holding the objects, or by manipulating them in some way.

RELATED ACTIVITIES

- A question box can be placed in the classroom. Encourage children to submit problems similar to those on the page for the class to discuss.

LESSON ACTIVITY

Before Using the Page

- Inform the children that today's lesson is different because numbers are not used. They could imagine themselves in a time when numbers were not known. Tell the children how shepherds, in primitive times, were able to count sheep without numbers. As each sheep left the cave in the morning, a shepherd could place a pebble at the entrance of the cave. At night, as each sheep returned, the shepherd could take a pebble from the pile. Ask the children how the shepherd knew if too few or too many sheep returned. Discuss the advantages and disadvantages of this counting system. Ask the children to think of similar counting systems for the same or for a different situation.

Solving Problems Without Using Numbers

Numbers are useful for solving problems, but sometimes they are not needed.

Answers will vary.

Without using numbers, how could you tell

1. which friend is taller?
2. which book has more pages?
3. which doll is heavier?
4. who is younger?
5. which bag has more marbles?
6. if there is a hat for each person?
7. which friend lives farther away?
8. which bottle holds more water?
9. which cup has colder lemonade?
10. which blanket is larger?
11. which string has more beads?
12. who rides faster on a bicycle?
13. if you need a coat for going outside?
14. which hole is deeper?
15. where to cut a ribbon to get 2 equal pieces?
16. who is shortest in the class?
17. who can take the longest step?
18. when it is time for lunch?
19. if the cookies are being shared equally?
20. which gerbil eats the most?
21. when summer is over?
22. who finishes first?

PROBLEM SOLVING

46

Using the Page

- Since these exercises lend themselves to discussion, suggested that answers be considered orally instead of writing. You may wish to make some of the problems mentioned on the page available to the children. Children could use the objects to demonstrate their solutions.
- For larger groups of children, you could guide the discussion and consider the problems in any order. The order could be determined by the interests of the children after they have a few minutes to read the problems.
- For smaller groups of children, each child has the opportunity to participate in the discussion. The children could work in groups of two or three on different problems. Later, have each group present their solutions and, if practical, demonstrate them.

OBJECTIVE

Demonstrate an understanding of the concepts and skills presented in this unit

RELATED ACTIVITIES

• The place-value pocket chart described on page T348 is a useful device for reviewing some of the concepts presented in this unit. Three suggestions are given below.

Show up to 9 hundreds, 9 tens, and 9 ones. Have the children write the standard numeral and the expanded numeral for each number.



Show not more than 8 hundreds and 8 tens, but show from 10 to 18 ones. Have the children write the number of each. Have them show the regrouping in the place-value chart and then write the numeral. Repeat for examples that require one or two regroupings.

Write a standard numeral and have children use the place-value chart to represent the number. Instruct the children to show, for example, 10 more ones. After each example is shown in the chart, have the children show the regrouping on paper.

$$\begin{array}{r} 1\ 13 \\ 42\cancel{1} \end{array}$$

47

Comments

For Ex. 6 and 10, more work with fractions greater than one may be necessary.

Children may require additional practice using zero as a place holder, as in Ex. 3, 4, 8, and 16.

For Ex. 12, children may need extra practice using decimals for showing amounts of money.

To understand the connection between place value and regrouping, children may require more practice with models for hundreds, tens, and ones.

Because the digits 3, 4, and 6 are used for each number in Ex. 24, ordering the numbers requires understanding of place value.

Checking Up

Write the numerals.

- three hundred fifty-six 356
- two hundred three 203
- two-thirds $\frac{2}{3}$

Write the words.

- four hundred twelve
- seven hundred five

Write the amounts using numerals.

- thirty-nine cents $39¢$ or $\$0.39$
- two dollars and four cents $\$2.04$

Write each number in expanded form.

- 547
- 208

Regroup and write each number in standard form.

hundreds	tens	ones
13	7	

9. 137

Write $>$ or $<$ to make a true statement.

- $373 \bigcirc 371$
- $402 \bigcirc 398$
- $256 \bigcirc 276$

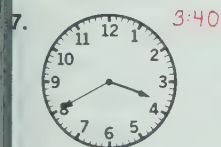
List the numbers in order from least to greatest.

- 364, 436, 634, 463, 346, 643 $346, 364, 436, 463, 634, 643$

Write the fraction that shows how much is shaded.



Write the time using numerals.



What day is today?

- six hundred 600
- one hundred eighty 180
- three and one-fourth $3\frac{1}{4}$

- three-tenths $\frac{3}{10}$
- three and one-half $3\frac{1}{2}$

Write the amounts using words.

- 42¢
- $\$1.79$

Write each number in standard form.

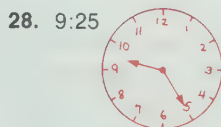
- $400 + 60 + 2$
- $300 + 20$

hundreds	tens	ones
2	9	14

20. 304



Draw a dial clock and show this time.



What month is it now?

	Exercises	Related Pages
numerals for words	1-4	T26-T29
fractions for words	5	T38-T39
mixed numbers for words	6	T40-T41
words for numerals	7,8	T26-T29
words for fractions	9	T38-T39
words for mixed numbers	10	T40-T41
amounts of money using numerals	11,12	T37
amounts of money using words	13,14	T37
change standard to expanded form	15,16	T30-T31
change expanded to standard form	17,18	T30-T31
compare tens and ones	19,20	T32-T33
compare numbers	21-23	T34-T35
order numbers	24	T34-T35
fractions less than one	25	T38-T39
mixed numbers less than ten	26	T40-T41
show time	27,28	T46-T47
calendar	29,30	T44-T45

Unit 3 Overview

Addition

This unit concentrates on developing the skill of adding two three-digit numbers with regrouping. Children are introduced directly to the standard algorithm, but the regrouping that is required is presented in three stages. The first stage presents only exercises that require no regrouping. Then only exercises that require regrouping of ones as tens are presented. The next stage involves only exercises that require regrouping tens as hundreds. Finally, exercises that require both regroupings are considered. Application is provided in work with adding amounts of money and in solving related word problems.

Practice with number patterns for extensions of basic addition facts is provided, and extensions are then applied in the addition of three one-digit numbers.

Prerequisite Skills

- complete the basic addition facts

Unit Outcomes

- add three one-digit numbers
- add two numbers with regrouping, sums to 999
- add amounts of money, sums to \$9.99
- solve word problems involving addition
- identify unnecessary information in a problem

Background

Unit 1 provided review and practice with basic addition facts. In Unit 2, children renamed numbers to show the standard form. Facility with both these topics is essential for the work of this unit—addition with regrouping. Ensure that children can interpret a three-digit number in terms of hundreds, tens, and ones. For example, 326 means 3 hundreds 2 tens 6 ones, and 405 means 4 hundreds 0 tens 5 ones. Children need to be able to rename a number to show the standard form. Exercises should involve one regrouping and two regroupings as shown.

- 2 hundreds 7 tens 15 ones
= 2 hundreds 8 tens 5 ones 285
- 3 hundreds 18 tens 2 ones
= 4 hundreds 8 tens 2 ones 482
- 5 hundreds 9 tens 16 ones
= 5 hundreds 10 tens 6 ones
= 6 hundreds 0 tens 6 ones 606

Note that the standard form for a number shows no more than 9 in any place. Regrouping in addition, then, is carried out to avoid writing in the sum a number greater than 9 in any column. The examples above, for instance, would be applied in the following additions.

1	1	1 1
1. 2 3 8	2. 1 9 0	3. 3 7 9
+ 4 7	+ 2 9 2	+ 2 2 7
<u> </u>	<u> </u>	<u> </u>
2 8 5	4 8 2	6 0 6

If the concept of regrouping among the places to show the standard form is well understood, it is easily applied to addition with regrouping. Note that an understanding of place value enables children to write addends in vertical form with their

places lined up to facilitate the addition. Any other arrangement usually leads to a tendency to add numbers whose place values are different and the resulting sum is incorrect, as shown in the example below.

Incorrect	Correct
6 3	6 3
+ 2 5 9	+ 2 5 9
<u> </u>	<u> </u>
8 8 9	3 2 2

The procedure of adding with regrouping is carried out in the right-to-left direction beginning with the ones, then the tens, then the hundreds, and so on. In this way the regrouping is completed as the addition is performed. To add 168 and 57, for example, the following steps would be carried out.

- Write the addends in vertical form.
- Add the ones.

1 6 8	1 6 8
+ 5 7	+ 5 7
<u> </u>	<u> </u>
15	

- Rename 10 ones as 1 ten.
- Add the tens.

1	1
1 6 8	1 6 8
+ 5 7	+ 5 7
<u> </u>	<u> </u>
5	12 5

- Rename 10 tens as 1 hundred.
- Add the hundreds.

1 1	1 1
1 6 8	1 6 8
+ 5 7	+ 5 7
<u> </u>	<u> </u>
2 5	2 2 5

Step-by-step procedures similar to the above are presented in the worked examples in the text, and are coordinated with illustrations of models of hundreds, tens, and ones. It is important to establish this right-to-left order of adding in the lesson of this unit even though the exercises at that time do not involve regrouping.

It is frequently found that children develop a tendency to regroup when, in fact, no regrouping is necessary. That is, they often show a regrouping for a column when the numbers in that column to the right give a sum less than ten, as in the following example.

1
2 7
+ 4 2
<u> </u>
9

Ex. 1 to 18 on page 54 help to draw this and other kinds of common errors in addition exercises to the children's attention and help to make them more aware of similar situations when they review their own work.

Work with amounts of money involving dollars, dimes, and pennies reinforces the concept of hundreds, tens, and ones. An amount of money consisting of 3 dollars, 6 dimes, and 4 pennies may be written as \$3.64. Addition with amounts of money, then, can be thought of in terms of dollars, dimes, and pennies. Ten pennies may be exchanged for one dime and ten dimes may be exchanged for one dollar.

1 1
\$ 3 . 6 5
+ 2 . 4 8
<u> </u>
\$ 6 . 1 3

Although the term “decimal point” is not encountered until Unit 7, you may wish to introduce it at this time. Explain that it separates the dollars from the cents in amounts of money. Remind the children that there are always two digits to the right of the decimal point to show the cents. For example, for “four dollars and three cents” we write \$4.03, which can be thought of as 4 dollars, 0 dimes, and 3 pennies. It is discussed in the Unit 1 Overview that a basic addition fact involves two one-digit addends as in $6 + 2 = 8$. Facts such as $6 + 2 = 18$ and $26 + 2 = 28$ are extensions of the basic fact $6 + 2 = 8$. Extensions are frequently encountered in addition problems with more than two numbers, as shown below.

$$\begin{array}{r} \text{A} \quad (8 + 9) + 3 \\ = 17 + 3 \\ = 20 \end{array}$$

$$\begin{array}{r} \text{B} \quad 8 + (9 + 3) \\ = 8 + 12 \\ = 20 \end{array}$$

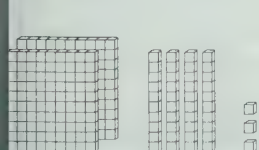
In A, $17 + 3 = 20$ is an extension of the basic addition fact $7 + 3 = 10$. In B, $8 + 12 = 20$ is an extension of the basic fact $8 + 2 = 10$. Knowing a basic addition fact helps in finding the sum for an extension of that fact. For instance, knowing $6 + 8 = 14$ helps in knowing $69 + 8 = 77$.

Preparatory to the work on addition of three one-digit numbers on page 53, children are introduced to number patterns on page 52, which involve extensions of basic addition facts. Exercises provide practice in applying extensions to add a two-digit number and a one-digit number.

Teaching Strategies

In Unit 2, attention was given to the hundreds, tens, and ones represented by the digits for a three-digit number. The children are introduced to the concept of regrouping. They are shown that ten ones can be regrouped as one ten, and ten tens can be regrouped as one hundred. In this unit the concept of regrouping is applied in the addition of three-digit numbers. Emphasis is given to the thought processes and the reasoning which promote an understanding of the algorithm.

A variety of teaching aids is useful for addition of three-digit numbers, particularly when regrouping is involved. Each new concept should be introduced using concrete materials such as base-ten Multibase Arithmetic Blocks similar to those illustrated on the previous pages, or sticks and tickets bundled in tens and hundreds. Diagrams of models of hundreds, tens, and ones (A) from page 46 are quite effective and can be related easily to representative materials in place-value pocket charts (see page 48), to numerals written on abacus charts (B), and to the standard numerals (C).



B

h	t	o
2	4	3

C 243

Abacus charts can be used effectively with numeral cards or numerals to demonstrate addition with regrouping. For the example in the following, the sum of 7 and 5 is 12. In the tens' column in the following example, the sum of 7 and 5 is 12, the numeral card 1 is shown first in the sum for the tens, and is then moved to the top of the tens' column to show regrouping. A similar procedure is applied in adding the ones.

h	t	o
1	1	
2	8	7
+ 6	4	5
9	3	2

Children can manipulate the materials as they perform the regrouping and be led gradually toward completing the algorithm on a purely abstract basis. The children should discontinue the use of concrete materials to indicate regrouping only when the procedures are clearly understood.

When writing solutions to word problems, it should be sufficient to have children write the required addition and a concluding statement. For example, for Ex. 21 on page 67, a complete solution might look like this.

$$\begin{array}{r} 11 \\ 176 \\ + 89 \\ \hline 265 \end{array} \quad \text{265 bicycles were checked.}$$

For work with amounts of money, it should be pointed out to the children that the same principles of regrouping ones, tens, and hundreds are applied to pennies, dimes, and dollars.

The number line is recommended for investigating extensions of basic addition facts. Number strips that are cut to match one to nine units of the demonstration number line may be placed along the line at different points and the patterns examined. For example, a four-strip may be used to demonstrate the pattern when 4 is added to a number that ends in 5, and children can observe that the sum always ends in 9.

$$\begin{array}{r} 4 \\ + 5 \\ \hline 9 \end{array} \quad \begin{array}{r} 14 \\ + 5 \\ \hline 19 \end{array} \quad \begin{array}{r} 24 \\ + 5 \\ \hline 29 \end{array} \quad \dots \quad \begin{array}{r} 94 \\ + 5 \\ \hline 99 \end{array}$$

Patterns that carry the sum into the next decade should also be examined. For instance, use a seven-strip to demonstrate the pattern when 7 is added to a number that ends in 6.

$$\begin{array}{r} 6 \\ + 7 \\ \hline 13 \end{array} \quad \begin{array}{r} 16 \\ + 7 \\ \hline 23 \end{array} \quad \begin{array}{r} 26 \\ + 7 \\ \hline 33 \end{array} \quad \dots \quad \begin{array}{r} 86 \\ + 7 \\ \hline 93 \end{array}$$

Experiences such as these can help children to name the sum of a one-digit number and a two-digit number by relating the addition to a basic fact.

While practice is provided in this unit for the development of the skill in addition, it will be necessary to review and provide further practice from time to time throughout the year to ensure retention of the skill. Some of this practice is provided through the features “Keeping Sharp” and “Checking Skills” in subsequent units.

Materials

models for hundreds, tens, and ones for each child
demonstration number line for 0 to 99; a number strip the length of seven units on the number line
real money or play money (dollars, dimes, pennies)
large piece of paper showing the information given inside the quotation marks on page T 70

Vocabulary

vertical form addition chain

LESSON OUTCOME

Add numbers with no regrouping, sums to 999

Materials

models for 9 hundreds, 9 tens, and 9 ones for each child (see page T361)

Vocabulary

vertical form

Prerequisite Skills

Complete basic addition facts, sums to 9

Checking Prerequisite Skills

Add.

1.

7

+ 2

9

2.

3

+ 3

6

3.

5

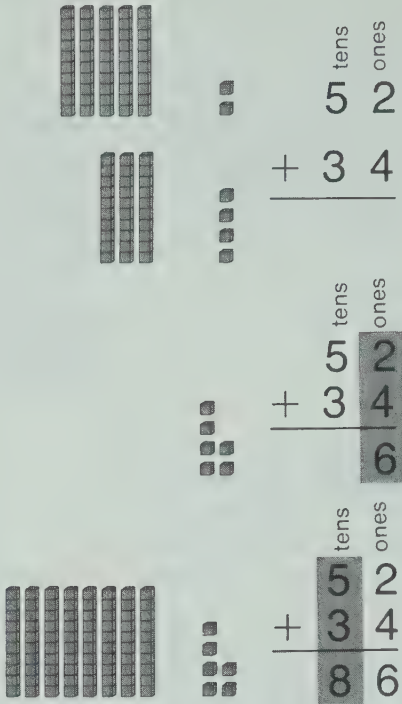
+ 4

9

Note: The development of the first example on page 48 is typical of the other examples throughout the book in which models are used. The instructions, the color on the numerals, and the illustrations of models are coordinated to show the step-by-step procedure for the operation. This method enables children to follow each step of the procedure. The method also relates each step of the procedure to the children's experience with the concrete models they used before discussing the page.

3 ADDITION
No Regrouping

Add 52 and 34.



Show 52 and 34 with their tens and ones lined up in vertical form.

Add the ones.

Add the tens.

The sum 52 + 34 is 86.

Add 215 and 364.

Add ones.

215

+ 364

9

Add tens.

215

+ 364

79

Add hundreds.

215

+ 364

579

215 plus 364 equals 579.

LESSON ACTIVITY

Before Using the Pages

- Review place value by discussing numerals having two and three digits as follows. Write each numeral on the board. Have the children use their models to represent each number. Ask for and record the number of ones, the number of tens, and then the number of hundreds on a place-value chart.
- Introduce joining models to represent addition in the following way. Have the children represent a two-digit number with their models. Ask for and record the number of ones, and then the number of tens as an addend on a place-value chart as shown. Repeat this for the other addend.
Have the children join their models for the ones. Ask for and record the number of ones in all. Repeat this for the tens. Ask for the number represented by this many tens and ones. Record the numeral under the chart as shown.

tens	ones
2	3
+ 4	3
6	6
66	

Repeat this procedure with a few exercises having three-digit addends.

Using the Pages

- As stated in the *Note* above, each step of the procedure shown separately. Have the children examine how the illustrations of models, the red on the numerals, and the instructions are coordinated for each step of the first worked example. Then have them examine how the red on the numerals and the instructions are coordinated for each step of the second worked example.

Working Together

Line up the hundreds, tens, and ones in vertical form.

1. $14 + 12 = 26$ 2. $41 + 8 = 49$ 3. $148 + 130 = 278$ 4. $212 + 65 = 277$

Follow the steps.

5. $163 + 214 = 377$ 6. $624 + 45 = 669$

Add.

7. $31 + 24 = 55$ 8. $332 + 356 = 688$ 9. $114 + 74 = 188$ 10. $304 + 393 = 697$

Exercises

Show the numbers in vertical form and add.

1. $31 + 52 = 83$ 2. $30 + 43 = 73$ 3. $16 + 50 = 66$ 4. $54 + 2 = 56$
5. $239 + 30 = 269$ 6. $417 + 242 = 659$ 7. $821 + 148 = 969$ 8. $453 + 6 = 459$

Add.

9. $24 + 45 = 69$ 10. $36 + 12 = 48$ 11. $52 + 43 = 95$ 12. $85 + 4 = 89$ 13. $80 + 17 = 97$
14. $44 + 44 = 88$ 15. $270 + 318 = 588$ 16. $166 + 21 = 187$ 17. $322 + 167 = 489$ 18. $157 + 330 = 487$
19. $16 + 232 = 248$ 20. $452 + 5 = 457$ 21. $6 + 92 = 98$ 22. $50 + 40 = 90$ 23. $500 + 200 = 700$
24. $715 + 73 = 788$ 25. $53 + 26 = 79$ 26. $102 + 541 = 643$ 27. $225 + 271 = 496$ 28. $340 + 16 = 356$

RELATED ACTIVITIES

Children may enjoy finding the hidden "bingo". Prepare copies of the following chart. Children complete the exercises in any order. Each sum is marked with an X on the chart when it is found. The children may stop work when they find the hidden "bingo" (4 sums in a row, a column, or a diagonal).

23	218	548	36
134	475	48	626
87	69	177	259
356	162	94	436

41 + 121 = 162 12 + 24 = 36 20 + 3 = 23
114 + 322 = 436 131 + 46 = 177 12 + 82 = 94
302 + 324 = 626 233 + 242 = 475 33 + 54 = 87
118 + 430 = 548 102 + 32 = 134 43 + 27 = 70

to emphasize the value of writing the numerals in vertical form for addition, write exercises similar to the following on the board.

$481 + 513$ $481 + 513$ $481 + 513$ $481 + 513$

Have the children choose which form makes addition easiest. Lead them to suggest that writing the numerals in vertical form facilitates adding the ones with the ones, the tens with the tens, and the hundreds with the hundreds.

Working Together: Emphasize the two main skills in this lesson:

lining up the hundreds, tens, and ones in vertical form; adding the ones, then the tens, and then the hundreds.

For Ex. 7-10 have the children think of these two main skills as they write the exercises and add. Provide similar exercises as needed.

Exercises: You may wish to remind the children to write Ex. 1-8 in vertical form.

Assessment

Add.

1. $82 + 4 = 86$ 2. $740 + 36 = 776$ 3. $235 + 162 = 397$ 4. $30 + 50 = 80$ 5. $324 + 274 = 598$

LESSON OUTCOME

Add numbers with regrouping ones as tens, sums to 999

Materials

models for 9 hundreds, 9 tens, and 18 ones for each child

Prerequisite Skills

Complete basic addition facts; add 3 numbers, sums less than 10

Checking Prerequisite Skills

Add.

1.

7

+ 4

11
2.

9

+ 3

12
3.

9

+ 8

17
4.

5

+ 8

13
5.

1

3

+ 2

6
6.

1

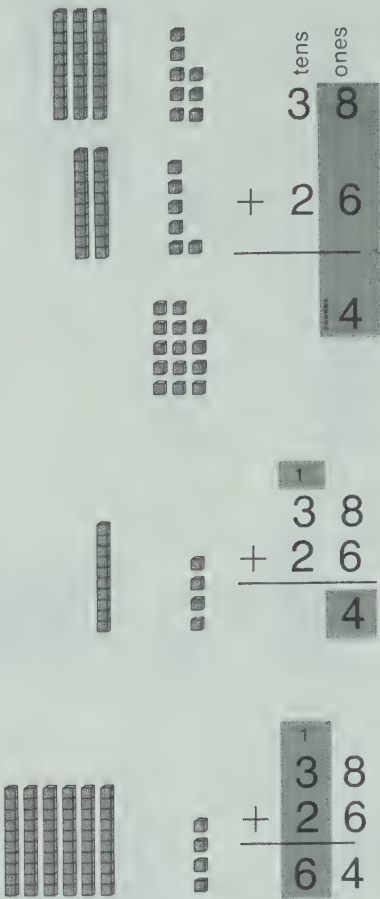
5

+ 2

8

Addition, Regrouping Ones to Tens

Find the sum of 38 and 26.



Show $38 + 26$ in vertical form.

Add the ones.

Regroup 14 ones as 1 ten and 4 ones. Show the 1 ten lined up with the other tens.

Add the tens.

The sum of 38 and 26 is 64.

LESSON ACTIVITY

Before Using the Pages

- To show regrouping 10 ones as 1 ten have the children begin by selecting models for 2 tens and 14 ones. Ask for and record on a place-value chart the number of ones and then the number of tens.
Tell the children that it is not the usual practice to write this many ones in the ones' place of a numeral. Cross out the 14 ones. Have the children group 10 ones and replace the models for 10 ones with a model for 1 ten. Ask for and record the number of ones remaining. Ask for the new number of tens. Record this above the 2 as shown. Then have the children join the models for the new ten and the original tens. Record this on the chart. Finally, ask for the number represented by 3 tens and 4 ones.

tens	ones
1	
2	14
3	4
34	

- Have the children select models to represent a two-digit number. Ask for and record the number of ones, and then the number of tens as an addend on a place-value chart. Repeat this for the other addend. Have the children join the models for the ones. Record this on the chart. Repeat the process for adding the tens.
Point out that there are too many ones in the ones' place. Have the children regroup the models as for the first activity. Record this in a similar way.

tens	ones
2	8
+ 3	5
1	
5	13
6	3
63	

Repeat this method with a few exercises having two- and three-digit addends.

Working Together

Regroup the 14 ones as 1 ten and 4 ones and complete the addition.

$$\begin{array}{r} \text{tens ones} \\ 1. \quad 4 \quad 7 \\ + 1 \quad 7 \\ \hline 14 \quad 64 \end{array}$$

$$\begin{array}{r} \text{tens ones} \\ 2. \quad 3 \quad 5 \\ + 5 \quad 9 \\ \hline 14 \quad 94 \end{array}$$

Regroup the ones as 1 ten and some ones and complete the addition.

$$\begin{array}{r} \text{tens ones} \\ 3. \quad 2 \quad 9 \\ + 4 \quad 6 \\ \hline 15 \quad 75 \end{array}$$

Add.

$$\begin{array}{r} 4. \quad 57 \\ + 19 \\ \hline 76 \end{array}$$

$$\begin{array}{r} 5. \quad 36 \\ + 47 \\ \hline 83 \end{array}$$

$$\begin{array}{r} 6. \quad 255 \\ + 25 \\ \hline 280 \end{array}$$

$$\begin{array}{r} 7. \quad 118 \\ + 173 \\ \hline 291 \end{array}$$

Exercises

Add.

$$\begin{array}{ll} 1. \quad 27 + 58 & 85 \\ 3. \quad 336 + 36 & 372 \\ 5. \quad 49 + 24 & 73 \\ 7. \quad 159 + 317 & 476 \end{array}$$

$$\begin{array}{ll} 2. \quad 75 + 17 & 92 \\ 4. \quad 43 + 8 & 51 \\ 6. \quad 461 + 25 & 486 \\ 8. \quad 54 + 37 & 91 \end{array}$$

$$\begin{array}{lllll} 9. \quad 26 & 10. \quad 49 & 11. \quad 717 & 12. \quad 18 & 13. \quad 135 \\ + 68 & + 35 & + 24 & + 15 & + 426 \\ \hline 94 & 84 & 741 & 33 & 561 \\ 14. \quad 669 & 15. \quad 236 & 16. \quad 122 & 17. \quad 27 & 18. \quad 535 \\ + 19 & + 359 & + 19 & + 35 & + 62 \\ \hline 688 & 595 & 141 & 62 & 597 \\ 19. \quad 348 & 20. \quad 16 & 21. \quad 31 & 22. \quad 355 & 23. \quad 228 \\ + 347 & + 65 & + 19 & + 38 & + 724 \\ \hline 695 & 81 & 50 & 393 & 952 \end{array}$$

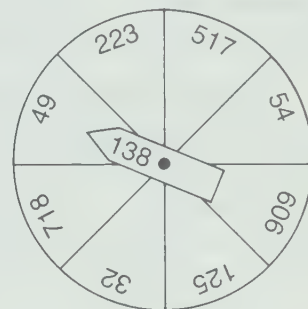
Solve.

- *24. 59¢ for 36 sheets of paper.
38¢ for 44 sheets of paper.
How many sheets of paper in all? 80
- *25. 59¢ for 36 sheets of paper.
38¢ for 44 sheets of paper.
How much in all for the paper? 97¢

51

RELATED ACTIVITIES

• The children could use a device similar to the one shown below to practice addition with regrouping ones as tens and without regrouping. The number printed on the spinner is one addend. The other addend is obtained by rotating the spinner. If the "dial" is covered with acetate and the numerals are written on the acetate, the numbers can be changed as the children's addition skills improve.



$$\begin{array}{r} 1 \\ 138 \\ + 49 \\ \hline 187 \end{array}$$

Working Together

See the Note on page T 52 for comments on the presentation of the worked examples. Have the children examine how the illustrations of models, the red on the numerals, and the instructions are coordinated for each step of the worked example. Compare the dotted 1 with the crossed out numerals in the ones' place on the charts developed in the initial activities. Since the dotted 1 is written beside the 4, it is written as a "thought of" numeral. In the next step, compare the locations of recording the new ten in the book and on the charts. Point out that the regrouping of 14 ones as 1 ten and 4 ones is done before adding the tens of the two addends so that the 1 ten may be included. Have the children conclude that regrouping the ones before adding the tens is a shorter method than that suggested in the initial activities.

Emphasize that regrouping occurs only to avoid writing a number greater than nine in a column. Ask why the ones are added before the tens.

Working Together: Since Ex. 1-3 are partially completed, an opportunity is provided to emphasize where the 1 representing the regrouped 10 ones is placed. Ex. 4-7 require that the children add the ones, regroup, and then add the tens. Give similar exercises if needed.

Exercises: Remind the children to use the vertical form for Ex. 1-8.

Ex. 24 and 25 are starred since more information than necessary is given. (See page 66.) Remind the children to answer the question in a sentence after showing the addition in vertical form.

Assessment

Add.

$$\begin{array}{llll} 1. \quad 35 & 2. \quad 28 & 3. \quad 34 & 4. \quad 208 \\ + 46 & + 12 & + 537 & + 628 \\ \hline 81 & 40 & 571 & 836 \\ 5. \quad 119 & & & \\ + 149 & & & \\ \hline 268 & & & \end{array}$$

LESSON OUTCOME

Apply extensions of basic facts to add a two-digit number and a one-digit number

Materials

a demonstration number line from 0 to 99, a number strip the length of seven units on the number line

Prerequisite Skills

Complete basic addition facts; count by tens

Checking Prerequisite Skills

Add.

1.

6

+ 8

14

2.

8

+ 9

17

3.

7

+ 4

11

4.

9

+ 9

18

5.

9

+ 1

10

6. Start at 3. Count by tens to 93.
3, 13, 23, 33, 43, 53, 63, 73, 83, 93
7. Start at 47. Count by tens to 97.
47, 57, 67, 77, 87, 97

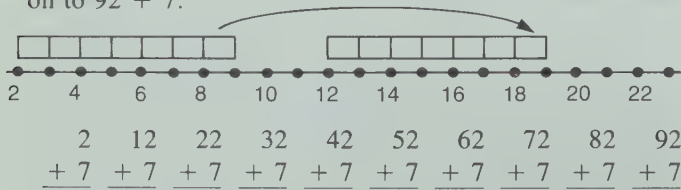
Background

A basic addition fact involves two one-digit addends, for example, 6 + 3. Exercises such as 16 + 3 and 26 + 3 are extensions of the basic fact 6 + 3. Knowing the basic fact helps in finding the sums for extensions of that fact. The ability to use extensions is crucial in doing column addition.

LESSON ACTIVITY

Before Using the Page

- Illustrate addition by holding the “seven” strip at 2 on the number line to show 2 + 7, at 12 to show 12 + 7, and so on to 92 + 7.



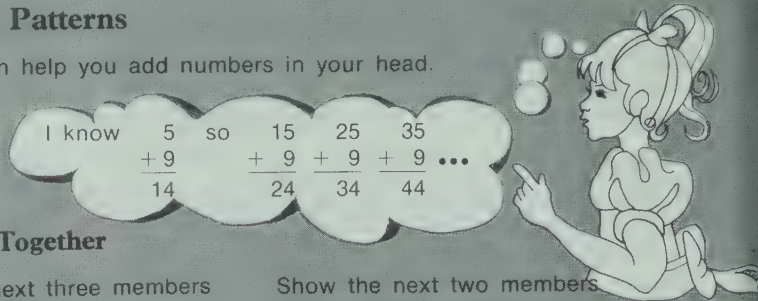
As each addition is shown, write the vertical form on the board. Have the children explore the pattern. Lead them to suggest the relation between the basic fact and each of the other additions shown. Repeat for the basic fact 9 + 7.

Using the Page

- Have the children extend the pattern of the worked example orally. Discuss the pattern and how it helps in addition.

Addition Patterns

Patterns can help you add numbers in your head.



Working Together

Show the next three members for this pattern.

Show the next two members on each side for this pattern.

1.

7

+ 4

11

17

+ 4

21

27

+ 4

31

37

+ 4

41

47

+ 4

51

57

+ 4

61

2.

24

+ 6

30

34

+ 6

40

44

+ 6

50

54

+ 6

60

64

+ 6

70

Show the next three members of the patterns that begin with these basic facts.

Add.

3.

5

+ 3

8

4.

9

+ 7

16

19

+ 7

26

29

+ 7

36

39

+ 7

46

5.

23

+ 4

27

6.

12

+ 8

20

7.

47

+ 5

52

3.

15

+ 3

18

25

+ 3

28

35

+ 3

38

Exercises

Show the next two members on each side for these patterns.

1.

23

+ 3

26

33

+ 3

36

43

+ 3

46

53

+ 3

56

2.

53

+ 7

60

63

+ 7

70

73

+ 7

80

83

+ 7

90

3.

38

+ 6

44

48

+ 6

54

58

+ 6

64

68

+ 6

74

Add.

4.

16

+ 8

24

5.

53

+ 9

62

6.

29

+ 6

35

7.

18

+ 8

26

8.

76

+ 4

80

9.

22

+ 6

28

10.

18

+ 7

25

11.

65

+ 6

71

12.

29

+ 1

30

13.

16

+ 7

23

14.

35

+ 2

37

15.

17

+ 6

23

16.

95

+ 8

103

17.

26

+ 6

32

18.

18

+ 3

21

19.

27

+ 8

35

20.

15

+ 5

20

21.

29

+ 4

33

52

Working Together: These exercises lead the children to extensions of basic facts rather than regrouping to add. Have the children write the answers for Ex. 1-4. For Ex. 5-7, have the children raise their hands when they know the answer as an indication of the speed at which they can use the basic facts. If the children have difficulty with Ex. 5, ask for the basic fact that is used for each. Provide more exercises if necessary.

Exercises: Encourage the children to work as quickly and accurately as possible. Since for this lesson they are using extensions of basic facts rather than regrouping, have the children record only the answer.

Assessment

Add.

1.

24

+ 8

32

2.

47

+ 9

56

3.

16

+ 5

21

4.

62

+ 8

70

5.

58

+ 9

67

LESSON OUTCOME

Add three one-digit numbers

Prerequisite Skills

Add a two-digit number and a one-digit number, sums to 27

Checking Prerequisite Skills

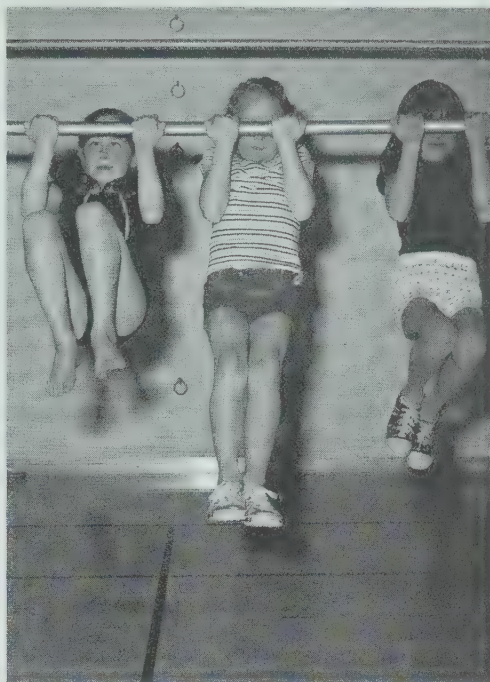
Add.

1. $18 + 7$ 25 2. $14 + 6$ 20

3. $12 + 9$ 21 4. $17 + 5$ 22

RELATED ACTIVITIES

• Children may play a game in groups of three or four using three dice: two marked 4, 5, 6, 7, 8, 9; one marked 1, 2, 3, 7, 8, 9. Players toss the dice in turn and add the numbers shown. For each round, the player with the greatest sum scores one point. At the end of an agreed number of rounds or a given time limit, the player with the highest score wins.



Adding Three Numbers

In the Canada Fitness Tests, the children were awarded 8 bronze, 8 silver, and 9 gold badges. How many badges were they awarded in all?

Add $8 + 8 + 9$.

8	Think	Write	8
8	16	8	
$+ 9$	$+ 9$	$+ 9$	
	25	25	

The children were awarded 25 badges.

Working Together

What numbers do you think of for A and B?

1. $\begin{array}{r} 5 \\ 9 \\ + 3 \\ \hline \end{array}$ A ? 14	2. $\begin{array}{r} 7 \\ 8 \\ + 6 \\ \hline \end{array}$ A ? 15
B ? 17	B ? 21

Add.

3. $\begin{array}{r} 8 \\ 2 \\ + 9 \\ \hline \end{array}$ 19	4. $\begin{array}{r} 9 \\ 7 \\ + 8 \\ \hline \end{array}$ 24
--	--

Exercises

Add.

1. $6 + 9 + 3$ 18	2. $5 + 8 + 4$ 17	3. $7 + 9 + 5$ 21	4. $8 + 8 + 8$ 24
5. $3 + 9 + 9$ 21	6. $4 + 7 + 8$ 19	7. $9 + 5 + 8$ 22	8. $3 + 7 + 5$ 15

9. $\begin{array}{r} 6 \\ 5 \\ + 6 \\ \hline \end{array}$ 17	10. $\begin{array}{r} 9 \\ 5 \\ + 7 \\ \hline \end{array}$ 21	11. $\begin{array}{r} 8 \\ 6 \\ + 9 \\ \hline \end{array}$ 23	12. $\begin{array}{r} 2 \\ 8 \\ + 3 \\ \hline \end{array}$ 13	13. $\begin{array}{r} 7 \\ 9 \\ + 6 \\ \hline \end{array}$ 22	14. $\begin{array}{r} 5 \\ 8 \\ + 9 \\ \hline \end{array}$ 22
--	---	---	---	---	---

53

LESSON ACTIVITY

Engaging the Page

Encourage the children to discuss the picture. Ask what the children are doing and why it is important to exercise. Explain that the Canada Fitness Tests encourage people to improve their level of fitness and to keep physically fit.

Read through the worked example. Ask whether the number of badges is different when the numbers are added up rather than down. Illustrate adding up for this exercise in a manner similar to the one on the page.

Working Together: The first two exercises help the children visualize the new addend and apply an extension of a basic fact to determine the final sum. Some children may need to write the partial sum for other exercises, using either of the following methods.

$$\begin{array}{r} 8 \\ 2 \\ + 9 \\ \hline 19 \end{array}$$

$$\begin{array}{r} 15 \\ 6 + 9 \\ + 3 \\ \hline 18 \end{array}$$

Exercises: Some children may benefit from showing the partial sums.

Assessment

Add.

1. $7 + 7 + 7$ 21	
2. $9 + 3 + 8$ 20	
3. $7 + 9 + 8$ 24	
4. $\begin{array}{r} 5 \\ 8 \\ + 6 \\ \hline \end{array}$ 19	5. $\begin{array}{r} 4 \\ 9 \\ + 5 \\ \hline \end{array}$ 18

OBJECTIVE

Demonstrate competence in addition with regrouping ones as tens and without regrouping; solve related word problems

Vocabulary

addition chain

Practice

Patty made 5 mistakes.
Find Patty's mistakes
and correct them.

September 15 Patty

1. $\begin{array}{r} 26 \\ +66 \\ \hline 92 \end{array}$ 2. $\begin{array}{r} 44 \\ +29 \\ \hline 73 \end{array}$ 3. $\begin{array}{r} 28 \\ +12 \\ \hline 40 \end{array}$ 4. $\begin{array}{r} 33 \\ +46 \\ \hline 79 \end{array}$ 5. $\begin{array}{r} 19 \\ +3 \\ \hline 22 \end{array}$ 6. $\begin{array}{r} 45 \\ +38 \\ \hline 83 \end{array}$

7. $\begin{array}{r} 15 \\ +37 \\ \hline 42 \end{array}$ 8. $\begin{array}{r} 58 \\ +13 \\ \hline 71 \end{array}$ 9. $\begin{array}{r} 15 \\ +4 \\ \hline 19 \end{array}$ 10. $\begin{array}{r} 64 \\ +16 \\ \hline 80 \end{array}$ 11. $\begin{array}{r} 48 \\ +29 \\ \hline 77 \end{array}$ 12. $\begin{array}{r} 15 \\ +52 \\ \hline 67 \end{array}$

13. $\begin{array}{r} 58 \\ +36 \\ \hline 94 \end{array}$ 14. $\begin{array}{r} 74 \\ +18 \\ \hline 92 \end{array}$ 15. $\begin{array}{r} 39 \\ +31 \\ \hline 70 \end{array}$ 16. $\begin{array}{r} 35 \\ +25 \\ \hline 60 \end{array}$ 17. $\begin{array}{r} 68 \\ +27 \\ \hline 95 \end{array}$ 18. $\begin{array}{r} 17 \\ +43 \\ \hline 60 \end{array}$

Complete each addition chain.

19. $\begin{array}{r} 8 \\ +7 \\ \hline 15 \end{array} \begin{array}{r} 15 \\ +8 \\ \hline 23 \end{array} \begin{array}{r} 23 \\ +9 \\ \hline 32 \end{array} \begin{array}{r} 32 \\ +10 \\ \hline 42 \end{array}$

20. $\begin{array}{r} 14 \\ +15 \\ \hline 29 \end{array} \begin{array}{r} 29 \\ +16 \\ \hline 45 \end{array} \begin{array}{r} 45 \\ +17 \\ \hline 62 \end{array} \begin{array}{r} 62 \\ +18 \\ \hline 80 \end{array}$

Show as many additions as you can using three numbers in a row.

$\begin{array}{r} 18 \\ +30 \\ \hline 48 \end{array} \begin{array}{r} 42 \\ +18 \\ \hline 60 \end{array} \begin{array}{r} 78 \\ +12 \\ \hline 90 \end{array} \begin{array}{r} 48 \\ +42 \\ \hline 90 \end{array} \begin{array}{r} 18 \\ +60 \\ \hline 78 \end{array} \begin{array}{r} 18 \\ +12 \\ \hline 30 \end{array} \begin{array}{r} 48 \\ +12 \\ \hline 60 \end{array} \begin{array}{r} 30 \\ +60 \\ \hline 90 \end{array}$

try this

1.

48	18	30
42	60	18
90	78	12

 $\begin{array}{r} 30 \\ +60 \\ \hline 90 \end{array}$

2.

12	35	23
35	24	59
47	11	36

3.

36	75	39
27	24	51
63	51	12

There are 8 additions possible for each square.

54. $\begin{array}{r} 12 \\ +23 \\ \hline 35 \end{array} \begin{array}{r} 35 \\ +24 \\ \hline 59 \end{array} \begin{array}{r} 36 \\ +11 \\ \hline 47 \end{array} \begin{array}{r} 12 \\ +35 \\ \hline 47 \end{array} \begin{array}{r} 24 \\ +11 \\ \hline 35 \end{array} \begin{array}{r} 23 \\ +36 \\ \hline 59 \end{array} \begin{array}{r} 12 \\ +24 \\ \hline 36 \end{array} \begin{array}{r} 23 \\ +24 \\ \hline 47 \end{array}$

LESSON ACTIVITY

Using the Pages

- Children could easily miss an error in Ex. 1-18 due to lack of attention. If, however, children are unable to understand an error that is pointed out or if they locate an error where none exists, determine which of the following areas is applicable. Patty's work shows three kinds of errors: forgetting to regroup 10 ones as 1 ten as in Ex. 7 and 15; regrouping 10 ones as 1 ten when there are fewer than 10 ones as in Ex. 9; incorrect addition for a basic fact as in Ex. 4 and 17. Children could use the following exercises for more practice in the area they find difficult while other children use a selection from *Related Activities*.

For more practice if the difficulty is forgetting to regroup 10 ones as 1 ten, use these examples.

1. $\begin{array}{r} 23 \\ +18 \\ \hline 41 \end{array}$ 2. $\begin{array}{r} 37 \\ +5 \\ \hline 42 \end{array}$ 3. $\begin{array}{r} 68 \\ +12 \\ \hline 80 \end{array}$

4. $\begin{array}{r} 74 \\ +29 \\ \hline 103 \end{array}$ 5. $\begin{array}{r} 45 \\ +35 \\ \hline 80 \end{array}$

For more practice if the difficulty is regrouping 10 ones as 1 ten when there are fewer than 10 ones, use these.

1. $\begin{array}{r} 14 \\ +23 \\ \hline 37 \end{array}$ 2. $\begin{array}{r} 63 \\ +20 \\ \hline 83 \end{array}$ 3. $\begin{array}{r} 52 \\ +7 \\ \hline 59 \end{array}$

4. $\begin{array}{r} 24 \\ +34 \\ \hline 58 \end{array}$ 5. $\begin{array}{r} 78 \\ +21 \\ \hline 99 \end{array}$

For more practice if the difficulty is incorrect addition a basic fact, use these.

1. $\begin{array}{r} 7 \\ +9 \\ \hline 16 \end{array}$ 2. $\begin{array}{r} 8 \\ +5 \\ \hline 13 \end{array}$ 3. $\begin{array}{r} 7 \\ +6 \\ \hline 13 \end{array}$

4. $\begin{array}{r} 9 \\ +6 \\ \hline 15 \end{array}$ 5. $\begin{array}{r} 8 \\ +9 \\ \hline 17 \end{array}$



Answer these questions.

21. 17 yellow pipe cleaners.
14 blue pipe cleaners.
How many pipe cleaners in all? **31**

23. 28 fat rubber bands.
34 thin rubber bands.
How many rubber bands in all? **62**

25. 22 large clamps.
18 small clamps.
How many clamps in all? **40**

27. 8 red, 5 blue, 7 green push pins. How many push pins in all? **20**

22. 143 big paper clips.
245 little paper clips.
How many paper clips in all? **388**

24. 37 long sticks.
57 short sticks.
How many sticks in all? **94**

26. 17 gummed squares.
7 gummed circles.
How many gummed shapes in all? **24**

*28. 16 used crayons.
Three boxes of new crayons.
How many crayons in all? **40**

For Ex. 19 and 20 ensure that the children understand the purpose of the arrows. Remind the children to check their final sum with the sum shown on the page and to correct the error if the sums are not the same.

For Ex. 21-28 remind the children to show the addition in vertical form and to answer the question in a sentence. Ex. 28 is starred because the solution requires more than one step and also the number of crayons in a new box. Although the number varies, you could have the children refer to the photograph on the page for the information.

Try This: These squares help children recognize numbers related by addition. Have the children copy the number squares. Then have them ring the three addends as they write the corresponding addition exercise.

RELATED ACTIVITIES

- The children may add to keep score for a game such as ring tossing or bean-bag throwing. The first team to have a score of 99 is the winner.
- Children may complete addition exercises using the numbers on a calendar for any month as addends. They may be interested in the sums for diagonal numbers from a block of four as shown.

SUN	MON	TUES	WED	THUR	FRI	SAT
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

$$\begin{array}{r} 19 \\ + 27 \\ \hline \end{array}$$

$$\begin{array}{r} 20 \\ + 26 \\ \hline \end{array}$$

- Children who experience some difficulty with this work may benefit from using models for hundreds, tens, and ones with an abacus chart to complete addition exercises. Have them represent the addends by placing models in the appropriate columns of the chart. Point out how this procedure corresponds to lining up the numerals in vertical form. Have the children join the sets of blocks for the ones, then for the tens, and then for the hundreds to find the number of each. This may then be translated into the standard form for the sum.

hundreds	tens	ones

$$\begin{array}{r|l|l} \text{h} & \text{t} & \text{o} \\ \hline 2 & 1 & 5 \\ + 1 & 3 & 6 \\ \hline \end{array}$$

LESSON OUTCOME

Add numbers with regrouping tens as hundreds, sums to 999

Materials

models for 9 hundreds, 18 tens, and 9 ones for each child

Prerequisite Skills

Complete basic facts; demonstrate competence in lining up numerals in vertical form for addition

Checking Prerequisite Skills

Add.

1.
$$\begin{array}{r} 9 \\ + 7 \\ \hline 16 \end{array}$$

2.
$$\begin{array}{r} 4 \\ + 8 \\ \hline 12 \end{array}$$

Line up the hundreds, tens, and ones in vertical form.

3.
$$\begin{array}{r} 6 \\ + 8 \\ \hline 14 \end{array}$$

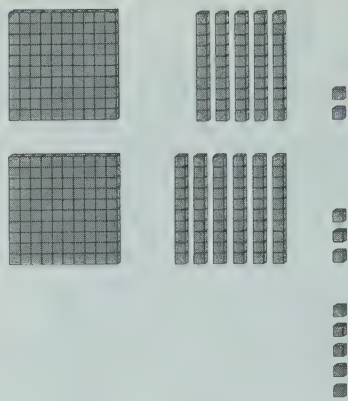
4.
$$\begin{array}{r} 7 \\ + 2 \\ \hline 9 \end{array}$$

5.
$$\begin{array}{r} 723 \\ + 140 \\ \hline \end{array}$$

6.
$$\begin{array}{r} 232 \\ + 41 \\ \hline \end{array}$$

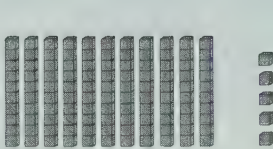
Addition, Regrouping Tens to Hundreds

Add 152 and 163.



$$\begin{array}{r} \text{hundreds} \quad \text{tens} \quad \text{ones} \\ 1 \quad 5 \quad 2 \\ + 1 \quad 6 \quad 3 \\ \hline \end{array}$$

Add the ones.



$$\begin{array}{r} 1 \quad 5 \quad 2 \\ + 1 \quad 6 \quad 3 \\ \hline \end{array}$$

Add the tens.

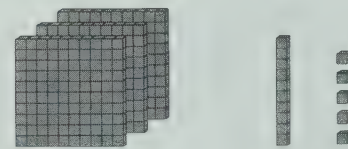
$$\begin{array}{r} 1 \quad 5 \quad 2 \\ + 1 \quad 6 \quad 3 \\ \hline \end{array}$$

Regroup 11 tens as 1 hundred and 1 ten. Show the 1 hundred lined up with the other hundreds.



$$\begin{array}{r} 1 \quad 5 \quad 2 \\ + 1 \quad 6 \quad 3 \\ \hline \end{array}$$

Add the hundreds.



152 + 163 = 315

LESSON ACTIVITY

Before Using the Pages

- To show regrouping 10 tens as 1 hundred begin by having the children select models for 3 hundreds and 15 tens. Ask for and record on a place-value chart the number of ones, tens, and hundreds.

Remind the children that a number greater than 9 should not be written in any column for a numeral. Cross out the 15 tens. Have the children group 10 tens and replace the models for 10 tens with a model for 1 hundred. Ask for and record the number of tens remaining. Then ask for the new number of tens. Record this above the 3 as shown. Then have the children join the models for the new hundred and the original hundreds. Record this on the chart. Finally, ask for and record the number represented by 4 hundreds and 5 tens.

hundreds	tens	ones
1		
3	15	0
4	5	

450

- Have the children select models to represent a three-digit number. Ask for and record the number of ones, then the number of tens, and then the number of hundreds as an addend on a place-value chart. Repeat this for the other addend. Have the children join the models for the ones. Ask for and record the number of ones in all. Repeat this for the tens, and then for the hundreds.

Point out that there are too many tens in the tens' place. Have the children regroup the models as for the first activity. Record this in a similar way.

hundreds	tens	ones
4	3	6
+ 2	9	2
1		
6	12	8
7	2	

728

Working Together

Regroup the 12 tens as 1 hundred and 2 tens and complete the addition.

hundreds tens ones	hundreds tens ones
1. $\begin{array}{r} 254 \\ + 172 \\ \hline 126 \\ + 172 \\ \hline 426 \end{array}$	2. $\begin{array}{r} 391 \\ + 234 \\ \hline 125 \\ + 234 \\ \hline 625 \end{array}$

Add.

3. $\begin{array}{r} 294 \\ + 153 \\ \hline 447 \end{array}$	4. $\begin{array}{r} 132 \\ + 85 \\ \hline 217 \end{array}$	5. $\begin{array}{r} 351 \\ + 154 \\ \hline 505 \end{array}$
--	---	--

Exercises

Copy this puzzle on paper and complete.

a	7	b	6	c	4	d	2
	4	e	8	6	2		4
f	9	5	9	2	7	9	
	7				4		
j	4	5	k	2	4	4	3
	3		n	5	3	2	0
o	8	1	0	p	8	2	6

Across

- a. 481 + 283
- c. 271 + 261
- e. 681 + 181
- f. 594 + 365
- h. 199 + 80
- j. 391 + 61
- l. 161 + 282
- n. 260 + 272
- o. 730 + 80
- p. 463 + 363

Down

- a. 572 + 177
- b. 298 + 191
- c. 271 + 251
- d. 178 + 71
- g. 191 + 384
- i. 472 + 272
- j. 254 + 184
- k. 170 + 80
- l. 282 + 146
- m. 153 + 153

RELATED ACTIVITIES

• For reinforcement, prepare cards similar to the one shown below. Each card suggests an addition exercise. If the cards are covered with acetate, children can write on the cards. Have the children ring 10 tens and write the addition exercise as shown. After the card has been checked, it can be cleaned for another child to use.

hundreds	tens	ones	
			$\begin{array}{r} 372 \\ + 253 \\ \hline 625 \end{array}$
5	12	5	

(Children having difficulty will likely need to write the total number of tens before renaming them.)

$$\begin{array}{r} 1 \\ 372 \\ + 253 \\ \hline 625 \\ 2 \end{array}$$

Using the Pages

See the *Note* on page T 52 for comments on the presentation of the worked examples. Have the children examine how the illustrations of models, the red on the numerals, and the instructions are coordinated for each step of the worked example. Review that the dotted 1 is thought of, not written, in the tens' place. In the next step, the 10 tens are regrouped and written as 1 hundred in the hundreds' place. Compare the locations of recording the new hundred in the book and on the charts. Point out that regrouping the tens is done before adding the hundreds so that the new 1 hundred may be included. Have the children conclude that regrouping the tens before adding the hundreds is a shorter method than that suggested in the initial activities.

Emphasize that regrouping occurs in order to avoid writing a number greater than nine in a column. Ask why the tens are added before the hundreds. Lead the children to suggest that before adding the hundreds it is necessary to determine whether the tens must be regrouped.

Working Together: The partially completed Ex. 1 and 2 allow the children to concentrate on regrouping tens as hundreds. The place names provided facilitate the regrouping. Use similar exercises until the children are able to think through all the steps of the procedure on their own.

Exercises: Provide the children with copies of page T 360 for the cross-number puzzle. Have them cut out a seven-by-seven grid. Then have them copy the letters in the appropriate squares and color the other squares. Review the procedure for completing a cross-number puzzle.

Assessment

Add.

1. $73 + 41$	114	3. 198	4. 164
2. $586 + 222$	808	$+ 380$	$+ 92$
		578	256

OBJECTIVE

Demonstrate competence in addition with one regrouping; solve related word problems

Practice

634

437

562

473

508

352

526

437

352

473

437

352

526

634

325

352

526

526

805

325

364

526

352

526

437

137

473

929

352

526

437

562

473

227

352

526

562

473

173

352

526

437

325

715

473

352

526

235



Brad tells a sad story.

1. Copy Brad's coded story. To decode it, first add to match each letter with a number.

A

314

+ 38

352

B

83

+ 90

173

D

352

+ 174

526

E

109

+ 28

137

F

555

+ 250

805

H

261

+ 176

437

I

224

+ 338

562

L

270

+ 238

508

M

415

+ 514

929

O

108

+ 217

325

P

182

+ 45

227

R

129

+ 235

364

S

236

+ 237

473

T

317

+ 317

634

W

463

+ 252

715

!

216

+ 19

235

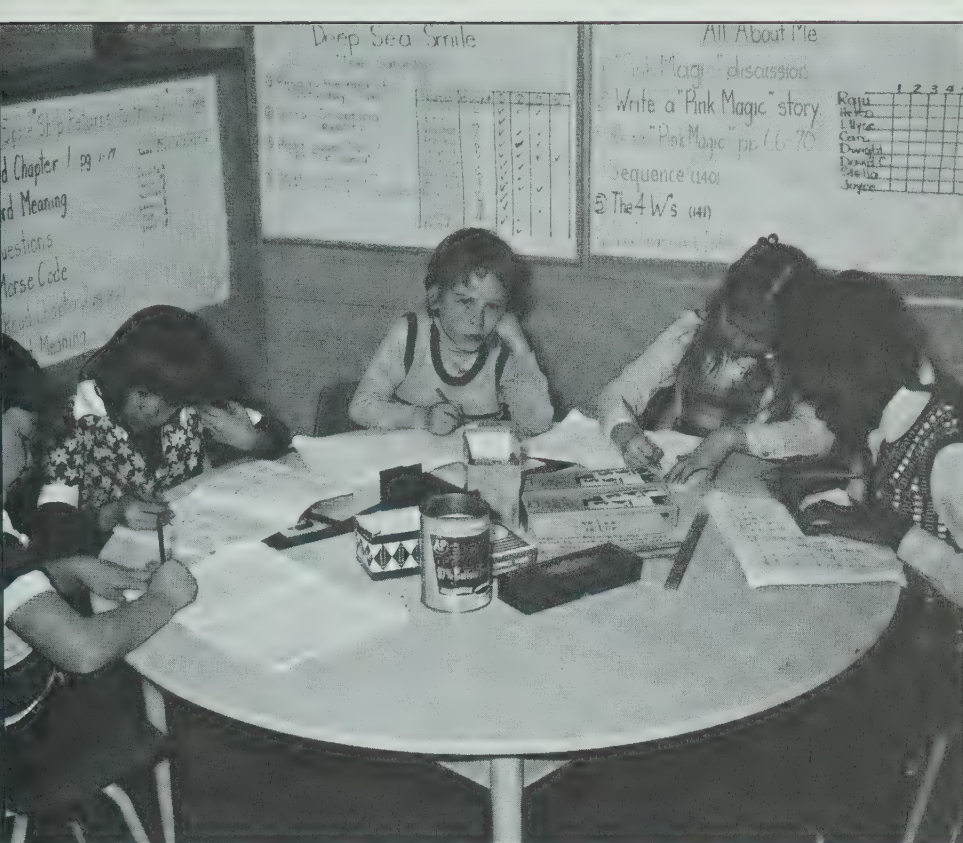
2. Then put the letters in place of their matching numbers in the story.

THIS LAD
HAS HAD TO ADD
FOR DAD HE'S MAD
HIS PAD IS BAD
HOW SAD!

LESSON ACTIVITY

Using the Pages

- Before the children open their books, ask them about their experiences in sending messages with codes.
- After the children open their books, use the illustration to compare Brad's code with the children's codes.
- Children may require assistance in understanding the instructions for matching the numbers and the letters in order to determine the message. Some children may wish to match a letter with each number as soon as each exercise is completed.
- Have the children answer Ex. 3-8 with an addition in vertical form and the answer in a sentence. Ex. 8 is starred because more information than necessary is given.



RELATED ACTIVITIES

- Some children may be interested in inventing a code or using Brad's code to send messages.
- Children may be encouraged to make up word problems. Each could be recorded on one side of a card having the solution on the other side. Ideas for word problems may arise from projects or field trips. Problem cards could be posted on the display board and used for further practice.

The children are practicing addition and subtraction.

- 128 addition exercises.
134 subtraction exercises.
How many exercises in all? **262**
- Paul did 97 addition exercises and 122 subtraction exercises.
How many did Paul do in all? **219**
- 191 exercises one week.
71 exercises the next week.
How many exercises in all? **262**
- Paul did 86 addition and 109 subtraction exercises correctly. How many did Paul do correctly in all? **195**
- Gail did 183 exercises one week and 64 the next week.
How many did she do in all? **247**
- *8. On a speed drill, Jo did 68 exercises in 17 minutes and 37 harder ones in 37 minutes.
How long did Jo take in all? **54 minutes**

Working Together

Follow the steps.

$$\begin{array}{r} 285 \\ + 167 \\ \hline 452 \end{array}$$

Add ones and regroup.

Add tens and regroup.

Add hundreds.

$$\begin{array}{r} 336 \\ + 284 \\ \hline 620 \end{array}$$

Add ones and regroup.

Add tens and regroup.

Add hundreds.



Using the metal in cans more than one time is a good idea. It saves energy and helps keep Canada clean.

The children made a chart. It shows about how much they can earn for the cans they collect.

Number of cans	Worth about
100	\$0.30
200	\$0.60
300	\$0.90
400	\$1.20
500	\$1.50
600	\$1.80
700	\$2.10
800	\$2.40
900	\$2.70

Derek found 387 cans.

Todd found 215 cans.

About how much did Derek and Todd earn for the class?

\$1.80

PROBLEM SOLVING

RELATED ACTIVITIES

• Some children will benefit from working addition exercises with felt numerals on a flannel board showing the heading for each place value. Several of each of the numerals 0 to 9 are required. Children may work alone or in pairs. (Have a capable child display the numerals for an exercise and guide another child in the addition.) For the example shown below, a child uses the felt numerals 1 and 5 to show 15 ones for the sum. To regroup, the child moves the felt numeral 1 from the ones' column to the top of the tens' column. A similar procedure is used to add and regroup tens as hundreds.

hundreds	tens	ones
1	8	8
+ 2	5	7
		15

Exercises

How many did each of these other teams collect?

1. Jim 289, Sheila 356 645
2. Wanda 167, Ian 193 360
3. Kristin 335, Effie 426 761
4. Andras 192, Julie 178 370
5. Lyman 245, Oliver 355 600

Add.

6. $\begin{array}{r} 435 \\ + 176 \\ \hline 611 \end{array}$
7. $\begin{array}{r} 87 \\ + 281 \\ \hline 368 \end{array}$
8. $\begin{array}{r} 644 \\ + 187 \\ \hline 831 \end{array}$
9. $\begin{array}{r} 559 \\ + 74 \\ \hline 633 \end{array}$
10. $\begin{array}{r} 394 \\ + 186 \\ \hline 580 \end{array}$
11. $\begin{array}{r} 277 \\ + 75 \\ \hline 352 \end{array}$
12. $\begin{array}{r} 439 \\ + 261 \\ \hline 700 \end{array}$
13. $\begin{array}{r} 783 \\ + 139 \\ \hline 922 \end{array}$
14. $\begin{array}{r} 146 \\ + 154 \\ \hline 300 \end{array}$
15. $\begin{array}{r} 897 \\ + 58 \\ \hline 955 \end{array}$
16. $\begin{array}{r} 666 \\ + 234 \\ \hline 900 \end{array}$
17. $\begin{array}{r} 509 \\ + 382 \\ \hline 891 \end{array}$

a picnic area. Use this discussion to introduce the word problem for the worked example. Have the children consider the use of addition to solve the word problem.

Have the children examine how the statements and the red on the numerals are coordinated for each step of the procedure. Remind the children that regrouping is used only when necessary. Ask why the ones are added first, then the tens, and then the hundreds. Lead the children to suggest that before adding the tens it is necessary to determine whether the ones must be regrouped and that before adding the hundreds it is necessary to determine whether the tens must be regrouped.

Working Together: The exercises indicate that two regroupings are required to complete the exercises. Some children may need further practice with exercises that do not indicate the number of regroupings.

Exercises: Caution the children that not all the additions require two regroupings. When they have finished, you may wish to ask which exercises require only one regrouping.

Problem Solving: Extend the discussion related to the illustration to consider the concept of recycling newspapers and metal cans.

The solution to this problem can be found in more than one way. Most children will find the sum of 387 and 215. Since this is just over 600, the earnings are \$1.80. Children who feel comfortable adding amounts of money may use the reverse approach along with intuitive "rounding" of numbers. For instance, Derek found about 400 cans and Todd found about 200 cans. Some children may think of adding \$1.20 and \$0.60 for a sum of \$1.80. Others may add 400 and 200 and see that for 600 cans, the earnings are \$1.80.

Assessment

Add.

1. $\begin{array}{r} 435 \\ + 394 \\ \hline 829 \end{array}$
2. $\begin{array}{r} 277 \\ + 39 \\ \hline 316 \end{array}$
3. $\begin{array}{r} 508 \\ + 196 \\ \hline 704 \end{array}$
4. $\begin{array}{r} 96 \\ + 74 \\ \hline 170 \end{array}$

OBJECTIVE

Demonstrate competence in addition with one or two regroupings; solve related word problems

Practice

Add.

1. $\begin{array}{r} 21 \\ + 33 \\ \hline 54 \end{array}$	2. $\begin{array}{r} 35 \\ + 42 \\ \hline 77 \end{array}$	3. $\begin{array}{r} 257 \\ + 31 \\ \hline 288 \end{array}$	4. $\begin{array}{r} 352 \\ + 247 \\ \hline 599 \end{array}$	5. $\begin{array}{r} 406 \\ + 273 \\ \hline 679 \end{array}$
6. $\begin{array}{r} 63 \\ + 5 \\ \hline 68 \end{array}$	7. $\begin{array}{r} 74 \\ + 9 \\ \hline 83 \end{array}$	8. $\begin{array}{r} 49 \\ + 7 \\ \hline 56 \end{array}$	9. $\begin{array}{r} 56 \\ + 8 \\ \hline 64 \end{array}$	10. $\begin{array}{r} 96 \\ + 4 \\ \hline 100 \end{array}$
11. $\begin{array}{r} 28 \\ + 47 \\ \hline 75 \end{array}$	12. $\begin{array}{r} 35 \\ + 56 \\ \hline 91 \end{array}$	13. $\begin{array}{r} 328 \\ + 35 \\ \hline 363 \end{array}$	14. $\begin{array}{r} 257 \\ + 219 \\ \hline 476 \end{array}$	15. $\begin{array}{r} 135 \\ + 125 \\ \hline 260 \end{array}$
16. $\begin{array}{r} 231 \\ + 97 \\ \hline 328 \end{array}$	17. $\begin{array}{r} 726 \\ + 192 \\ \hline 918 \end{array}$	18. $\begin{array}{r} 173 \\ + 66 \\ \hline 239 \end{array}$	19. $\begin{array}{r} 463 \\ + 371 \\ \hline 834 \end{array}$	20. $\begin{array}{r} 193 \\ + 486 \\ \hline 679 \end{array}$
21. $\begin{array}{r} 86 \\ + 45 \\ \hline 131 \end{array}$	22. $\begin{array}{r} 28 \\ + 83 \\ \hline 111 \end{array}$	23. $\begin{array}{r} 876 \\ + 26 \\ \hline 902 \end{array}$	24. $\begin{array}{r} 479 \\ + 352 \\ \hline 831 \end{array}$	25. $\begin{array}{r} 254 \\ + 577 \\ \hline 831 \end{array}$
26. $\begin{array}{r} 286 \\ + 129 \\ \hline 415 \end{array}$	27. $\begin{array}{r} 79 \\ + 39 \\ \hline 118 \end{array}$	28. $\begin{array}{r} 314 \\ + 386 \\ \hline 700 \end{array}$	29. $\begin{array}{r} 604 \\ + 98 \\ \hline 702 \end{array}$	30. $\begin{array}{r} 180 \\ + 286 \\ \hline 466 \end{array}$
31. $\begin{array}{r} 247 \\ + 658 \\ \hline 905 \end{array}$	32. $\begin{array}{r} 475 \\ + 479 \\ \hline 954 \end{array}$	33. $\begin{array}{r} 89 \\ + 16 \\ \hline 105 \end{array}$	34. $\begin{array}{r} 607 \\ + 154 \\ \hline 761 \end{array}$	35. $\begin{array}{r} 135 \\ + 688 \\ \hline 823 \end{array}$

The class took a trip to the fire station.
Here are some things the children learned.

36. 366 m (metres) of large hose and 155 m of small hose are on a pumper truck. How many metres of hose are on the pumper truck in all? **521**
37. The station had 365 calls in the first two weeks of the month. It had 479 calls in the last two weeks. How many calls were there in all? **864**
38. Two trucks answer a call. They take 5 minutes to reach a false alarm. They take 17 more minutes to return. How long were they gone from the station? **22 minutes**
39. Last year the station put out 214 building and car fires. It also put out 67 trash and grass fires. How many fires did it put out in all? **281**

62

LESSON ACTIVITY

Using the Pages

- Most of Ex. 1-35 are arranged so that children progress through the kinds of addition exercises in the order they are presented in this unit: Ex. 1-6 involve no regrouping; Ex. 7-15 involve regrouping ones as tens; Ex. 16-20 involve regrouping tens as hundreds; Ex. 21-35 involve two regroupings. The exceptions are Ex. 30 and 34. This arrangement reviews the progression of steps. Also, it enables you to determine whether more practice is required for each step.
- Some children may need help reading Ex. 36-41. Ex. 41 is starred because the solution involves two steps.
- Ask the children where numerals similar to the ones for Ex. 42 and 43 are found. Some children may have difficulty reading these numerals. If so, have them trace the red bars with their fingers to form the numerals.



RELATED ACTIVITIES

• Children may work in pairs for the following activity, using one red die marked 4, 5, 6, 7, 8, 9 for ones, one blue die marked 4, 5, 6, 7, 8, 9 for tens, and one yellow die marked 1, 2, 3, 3, 4, 4 for hundreds. Each child in turn tosses the dice and writes the corresponding three-place numeral. The two numerals form an addition exercise. Each child completes the addition exercise, and the two answers are compared as a check.

What would the calculator show for the sum?

42.

43.

40. Once there were two big fires on the same night. 85 fire fighters were at one. 67 were at the other. How many fought the fires? **152**

41. In a school fire drill, 112 children left by the front door. 58 left by one back door and 65 left by the other back door. Did more leave by the front or back? **back**

LESSON OUTCOME

Add amounts of money, sums to \$9.99

Materials

real money or play money (dollars, dimes, and pennies)

Prerequisite Skills

Add numbers with two regroupings, sums to 999

Checking Prerequisite Skills

Add.

1. $\begin{array}{r} 367 \\ + 235 \\ \hline 602 \end{array}$	2. $\begin{array}{r} 199 \\ + 249 \\ \hline 448 \end{array}$	3. $\begin{array}{r} 69 \\ + 255 \\ \hline 324 \end{array}$
--	--	---

Adding Amounts of Money

Bicycle Inspection Day is next Monday at school. To get ready, Barbara spent \$2.58 for a light and \$1.69 for a horn. How much did she spend in all?

BATTERY-OPERATED
LIGHT
\$2.58



Add \$2.58 and \$1.69.

$$\begin{array}{r} ^1 ^1 \\ \$2.58 \\ + 1.69 \\ \hline \$4.27 \end{array}$$



SPEEDOMETER
\$7.89



BANANA SEAT
\$6.79

Barbara spent \$4.27 in all.

Working Together

Line up the dollars and cents in vertical form.

Add.

1. $\begin{array}{r} \$4.98 \\ + \$3.26 \\ \hline \$8.24 \end{array}$	2. $\begin{array}{r} \$2.25 \\ + \$0.39 \\ \hline \$2.64 \end{array}$	3. $\begin{array}{r} \$1.75 \\ + 0.57 \\ \hline \$2.32 \end{array}$	4. $\begin{array}{r} \$5.84 \\ + 1.88 \\ \hline \$7.72 \end{array}$
---	---	---	---

Exercises

Add.

1. $\begin{array}{r} \$1.98 \\ + \$3.76 \\ \hline \$5.74 \end{array}$	2. $\begin{array}{r} \$2.05 \\ + \$0.87 \\ \hline \$2.92 \end{array}$	3. $\begin{array}{r} \$4.99 \\ + \$4.89 \\ \hline \$9.88 \end{array}$
4. $\begin{array}{r} \$2.35 \\ + 1.79 \\ \hline \$4.14 \end{array}$	5. $\begin{array}{r} \$4.28 \\ + 3.57 \\ \hline \$7.85 \end{array}$	6. $\begin{array}{r} \$5.29 \\ + 0.83 \\ \hline \$6.12 \end{array}$
		7. $\begin{array}{r} \$4.75 \\ + 2.68 \\ \hline \$7.43 \end{array}$

64

LESSON ACTIVITY

Before Using the Pages

- Use the chart shown to review amounts of money.

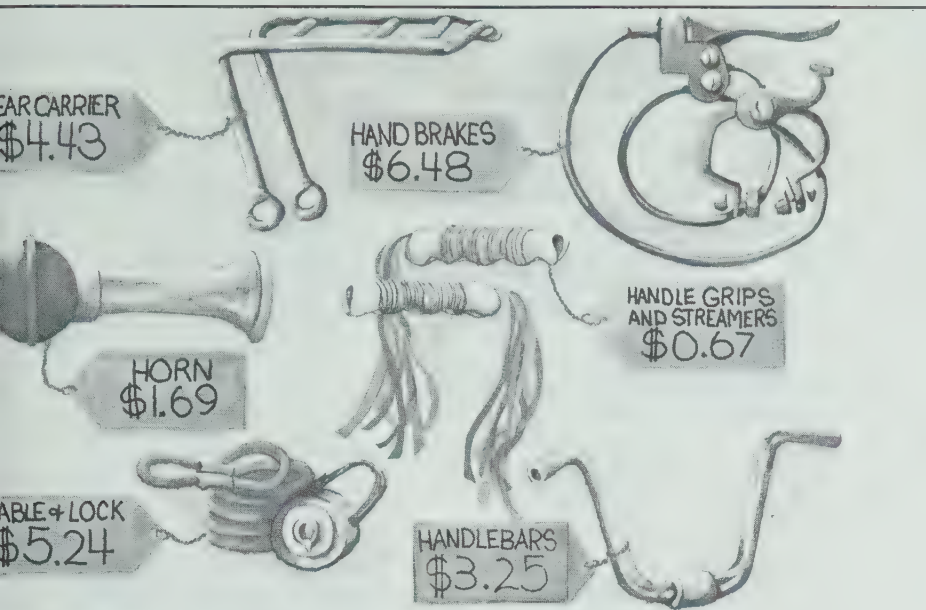
Dollars	Dimes	Pennies	Amount

Display bills and coins to show amounts to \$9.99. Have a child name the number of dollars. Have another child record this on the chart. Repeat this for the number of dimes and for the number of pennies. Then have a child state the amount of money displayed. Have a child record this on the chart. Emphasize the position of the dollar sign and of the decimal point.

- Reverse the procedure above and write the amount on chart. Have children complete the other sections of chart and then select bills and coins to show the amount named.
- Use the chart without the real or play money to show regrouping with amounts of money as follows. Write numerals for more than nine pennies and more than nine dimes in the "Dollars", "Dimes", and "Pennies" columns of the chart. An example is 2 dollars, 15 dimes and 13 pennies. Have the children regroup pennies to dimes, regroup dimes to dollars, and then record amount on the chart.

Using the Pages

- Have the children discuss the objects illustrated. They require help with the names of the bicycle parts. Then ask questions similar to the following.
 - "How much does the horn cost?"
 - "What is the price of the speedometer?"
 - "What does a speedometer measure?"



RELATED ACTIVITIES

- You may wish to have children choose pairs of items shown on the page. Have the children find the cost of the two items selected. Observe whether the children are able to work with sums greater than \$10.00.
- Children may be instructed in finding pictures of items costing less than \$5.00 in magazines, catalogs, and newspapers. Display these for several days. Have the children pretend to purchase two items at a time and find the cost.

How much do these cost in all?

- Banana seat and horn \$8.48
- Speedometer and handle grips \$8.56
- Tommy wants the banana seat and the handle grips. How much money does he need? \$7.46
- Which cost more, the brakes and handlebars or the banana seat and light? brakes and handlebars
- Ginny needs a cable lock and a horn. She has \$7.00. Is that enough? yes
- Cable lock and rear carrier \$9.67
- Brakes and light \$9.06
- Sara earned \$3.75 for her bike equipment. Her mother gave her \$2.75 more. How much did she have in all? \$6.50
- The speedometer and horn come in a package for \$9. Do they cost less in a package or not in a package? in a package
- Nadia has \$5.00. She bought two items. What two items could they be? handle grips and handlebars, handle grips and light, handle grips and horn, horn and light, or horn and handlebars

65

“Which item is the least expensive?”

“Which item is the most expensive?”

Use this discussion to introduce the word problem for the worked example. Have the children consider the use of addition to solve the word problem.

Discuss the steps of adding the pennies, regrouping pennies as dimes, adding the dimes, regrouping dimes as dollars, and then adding the dollars. Emphasize lining up the numerals in vertical form. Without discussing the decimal point in detail, point out that it is useful when lining up the numerals.

Working Together: Emphasize lining up the numerals and writing the dollar sign and the decimal point. Provide similar exercises as needed.

Exercises: For each of Ex. 8-17, remind the children to show the addition in vertical form and answer each question in a sentence. Ex. 14-16 are starred because their solutions require more than just an addition exercise. Ex. 17 is starred because there is more than one possible answer.

Have children experiencing difficulty with the exercises use real or play money to show the amounts and find the sums.

Assessment

Add.

$$\begin{array}{r} 1. \quad \$4.95 \\ + 2.68 \\ \hline \$7.63 \end{array}$$

$$\begin{array}{r} 2. \quad \$0.98 \\ + 0.98 \\ \hline \$1.96 \end{array}$$

$$\begin{array}{r} 3. \quad \$4.09 \\ + 2.95 \\ \hline \$7.04 \end{array}$$

Solve.

- Bill rode in a “bike-a-thon”. He collected \$2.88 from one sponsor and \$4.32 from another sponsor. How much did he collect from these two sponsors? \$7.20

OBJECTIVE

Identify unnecessary information in a problem

Materials

a large piece of paper with the information shown in *Before Using the Page*

RELATED ACTIVITIES

- Encourage the children to be more aware of unnecessary information when working problems in the future. Some children may enjoy inventing problems of their own for other children to identify the unnecessary information.
- If you did not have time earlier in the unit for Ex. 24 and 25 on page 51 and Ex. 8 on page 59, they could be discussed now since they are also applicable at this time.

Too Much Information

Sometimes there is more information than needed for solving a problem.

Example: Jeff had 7 pencils.
He bought 8 more.
He paid 75¢.
How many pencils
does he have in all?

This is not needed
for solving the problem.

What information is not needed for solving each problem?

- Marc's class has 11 girls.
5 girls have brown hair.
Marc's class has 9 boys.
How many are in Marc's class?
- 6 paper clips are large.
9 paper clips are small.
Jeri takes 3 small clips.
How many small clips are left?
- I had 17 pens.
8 pens were worn out.
I threw away 8 pens.
How many pens do I have left?
- 8 socks are brown. 6 socks are blue. 2 socks have holes.
How many more brown socks than blue socks are there?
- On Wednesday, 6 books were taken from the library.
9 were taken on Thursday.
15 were taken on Friday.
How many fewer were taken on Thursday than on Friday?
- 7 crayons are new.
5 crayons are used.
3 of them are blue.
How many crayons are there?
- There are 2 pencil sharpeners.
5 pencils need sharpening.
7 pencils are sharp.
How many pencils are there?
- 7 girls and 5 boys used paste. 8 children used glue. How many children used paste?
- There are 7 thick books, 3 thin books, 10 library cards, and 2 pens. How many books are there in all?
- Lee made 7 peanut butter sandwiches. 5 jelly sandwiches, and 6 sandwiches with peanut butter and jelly. On how many sandwiches did Lee use jelly?

PROBLEM SOLVING

66

LESSON ACTIVITY

Before Using the Page

- Tell the children that you will read some information about the classroom and then ask them a question. Read, for example,

"Our classroom has
5 gerbils,
4 goldfish,
13 boys,
29 chairs,
1 rabbit,
28 tables,
5 plants,
14 girls.

How many pets are there in our classroom?"

The children may enjoy discussing their ideas about the answer. Lead them to suggest that since they did not know the question while the list was being read, they did not listen for the information that is needed to answer the

question. Record the information on the board. Have children tell what information is not necessary answering the question.

Using the Page

- Read the worked example with the children. Explain that it is important to read the entire problem very carefully more than once to be certain about the question and unnecessary facts.
- Encourage the children to read each problem carefully. Help the children who need assistance with reading. In order to allow the children to concentrate on finding the unnecessary information, they are not asked to solve the problems. You may wish to have the children solve the problems as a follow-up activity.

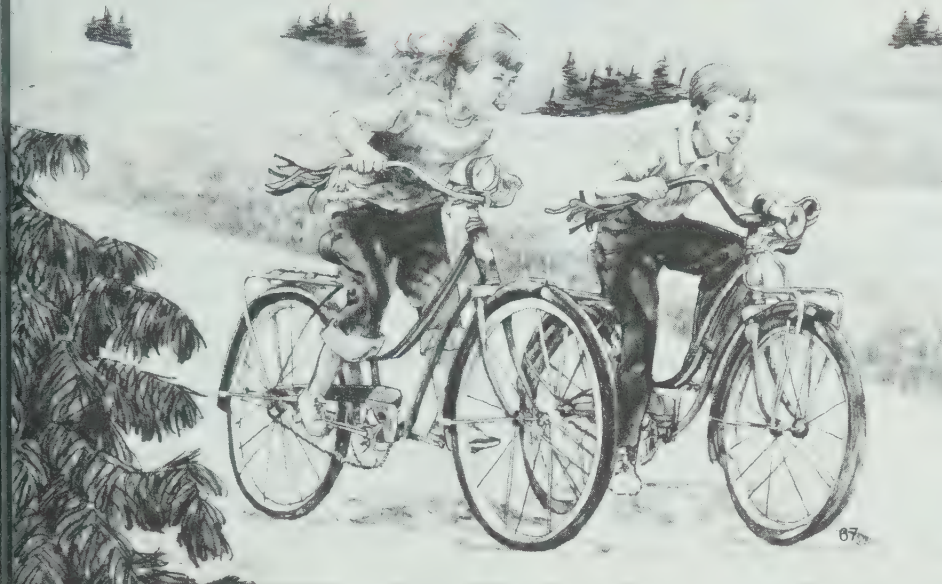
Checking Up

Add.

1. $\begin{array}{r} 43 \\ + 24 \\ \hline 67 \end{array}$
2. $467 + 21 \text{ } 488$
3. $\begin{array}{r} 341 \\ + 236 \\ \hline 577 \end{array}$
4. $291 + 104 \text{ } 395$
5. $54 + 27 \text{ } 81$
6. $\begin{array}{r} 46 \\ + 8 \\ \hline 54 \end{array}$
7. $373 + 19 \text{ } 392$
8. $\begin{array}{r} 259 \\ + 123 \\ \hline 382 \end{array}$
9. $\begin{array}{r} 80 \\ + 49 \\ \hline 129 \end{array}$
10. $\begin{array}{r} 892 \\ + 76 \\ \hline 968 \end{array}$
11. $\begin{array}{r} 173 \\ + 294 \\ \hline 467 \end{array}$
12. $\begin{array}{r} 541 \\ + 393 \\ \hline 934 \end{array}$
13. $\begin{array}{r} 275 \\ + 469 \\ \hline 744 \end{array}$
14. $\begin{array}{r} 458 \\ + 77 \\ \hline 535 \end{array}$
15. $\begin{array}{r} 746 \\ + 157 \\ \hline 903 \end{array}$
16. $\begin{array}{r} 894 \\ + 96 \\ \hline 990 \end{array}$
17. $\begin{array}{r} \$4.25 \\ + 4.60 \\ \hline \$8.85 \end{array}$
18. $\begin{array}{r} \$6.73 \\ + 2.71 \\ \hline \$9.44 \end{array}$
19. $\begin{array}{r} \$3.85 \\ + 1.08 \\ \hline \$4.93 \end{array}$
20. $\begin{array}{r} \$5.46 \\ + 0.85 \\ \hline \$6.31 \end{array}$

Solve.

21. 176 bikes checked on Tuesday.
89 bikes checked on Thursday.
How many bikes were checked
in all on those two days? 265
22. \$5.83 for a bicycle seat.
\$3.57 for handlebars.
How much for a seat and
handlebars in all? $\$9.40$



OBJECTIVE

Demonstrate an understanding of the concepts and skills presented in this unit

RELATED ACTIVITIES

- Further practice with addition of three one-digit numbers can be given in the form of a number square as shown. Have the children add horizontally (left to right and right to left), vertically (up and down), and diagonally.

	6	8	7	
	3	9	4	
	8	5	7	

- When adding three one-digit numbers, extensions of basic facts are used. For practice of extensions of basic addition facts have the children complete the following addition table. (Copies of page T 360 may be used.)

+	1	2	3	4	5	6	7	8	9
10									
11									
12									
13									
14									
15									
16									
17									
18									

Skills	Exercises	Related Pages
no regrouping	1-4	T 52-T 53
regrouping ones as tens	5-8	T 54-T 55
regrouping tens as hundreds	9-12	T 60-T 61
two regroupings	13-16	T 64-T 65
amounts of money	17-20	T 68-T 69
word addition problems	21,22	

Comments

The chart showing the skills required for each exercise on this page facilitates locating an area of difficulty. Usually children who answer correctly almost all the exercises for a skill have mastered that skill. Children should review a skill for which they answer only half the exercises correctly. If children answer less than half of them correctly, that skill should be retaught. Children who appear to have difficulty with a certain skill may need review of one or more of the required prerequisite skills.

Unit 4 Overview

Geometry

This unit provides the children with an opportunity to investigate basic concepts of geometry through experiences that can prove exciting and enjoyable. Emphasis is given to exploration of the concepts with a view to language development rather than mastery. For example, the abstract concepts of point and line segment can be internalized only after many experiences over an extended period of time.

The unit begins with a refinement of the observation and classification skills that were an important part of the first phases of the primary program. These skills are then used to study, describe, and identify a variety of three-dimensional shapes. These shapes are then analyzed more closely. From a study of the faces, comes a review of two-dimensional shapes. From a study of edges and vertices, come the concepts of line segment and point, respectively. In the latter part of the unit, the concept of a line segment is more fully developed, and children are involved in drawing representations of line segments with the help of a straight edge.

Unit Outcomes

- identify likenesses and differences in familiar objects
- recognize properties of solids (cube, cylinder, cone, prism, cuboid, pyramid, sphere)
- compare solids and objects with similar shapes
- recognize and illustrate likenesses and differences in the shapes of faces of solids (triangle, rectangle, square, pentagon, hexagon, octagon, circle)
- count vertices, edges, points, and line segments; relate vertices to points, and edges to line segments
- identify, draw, and compare line segments

Background

The approach to geometric concepts at this level is based on an intuitive development. That is, children discover that geometric concepts can be developed from their own observations about shapes and the relations between shapes. Certain concepts which are the fundamental building blocks of geometry include *point*, *line*, *line segment*, *plane*, and *space*. An understanding of these terms enables children to express their ideas clearly. The terms are discussed here for the teacher's benefit. It is not anticipated that the children will be expected to describe these concepts.

A *point* has no length, width, or thickness. It is considered to indicate a particular location in space.

A *line* is considered to be a set of points forming a straight path that continues without end in opposite directions.

A *line segment* is part of a line consisting of two points (end points) and all the points that lie between them.

A *plane* is the set of all points on a flat surface whose length and width extend endlessly.

Space is considered to be the set of all points.

Children develop an understanding of such concepts by assuming the particular properties and experiencing the assumptions over an extended period of time.

Children at this level likely will have had previous experiences with geometric shapes and will be familiar with shapes that are circular, square, triangular, or rectangular. They

may be less familiar with three-dimensional shapes and the terminology associated with them.

A *face* is a flat surface of a three-dimensional solid.

An *edge* is a line segment formed where two plane surfaces of a solid meet.

A *vertex* of a solid is the common end point of three or more faces.

Again, these terms are explained only for the teacher's benefit.

The terms *face*, *edge*, and *vertex* for three-dimensional solids correspond to the two-dimensional terms *plane*, *line segment*, and *point*, respectively. Children are thereby able to make associations between two-dimensional shapes and three-dimensional shapes.

Teaching Strategies

This unit offers a refreshing change from the study of numbers and operations. Activities that involve manipulating familiar objects such as boxes and cans are enjoyable to children as this is usually associated with play rather than with work. The teacher, with the help of the children, may wish to collect a variety of objects, such as wooden boxes, cans, cereal boxes, blocks, cones, cubes, and cylindrical shapes, for use in lessons and follow-up activities that involve building, sorting, and classifying shapes.

The unit begins with the study of three-dimensional shapes and the implication is that children will work actively with concrete materials, observing and manipulating the solids and noting such things as which can roll, which can slide, which can be stacked. The solids are easily matched to many everyday objects of similar shape. The study of three-dimensional shapes provides an excellent application of skills in observation and classification. Through activities such as these, children can discover properties of the various solids, notably those concerning vertices, faces, and edges. For example, a sphere has no vertices, faces, or edges. A cube has eight vertices and six identical faces. A cylinder has no vertices and two identical faces.

The general exploration of solids leads naturally to a study of their faces. For each group of similar solids, children can count and trace all the faces of each particular solid. These can then be used to review the two-dimensional shapes, triangle, square, rectangle, circle, and to introduce the pentagon, hexagon, and octagon. A discussion of flat surfaces and curved surfaces can be used to assist children in clarifying the concept of a plane.

Further observation and discussion of the likenesses and differences of solids leads to classification of the solids in terms of the number of faces, edges, and vertices. At the same time, children can clarify their concepts of point and line segment as they count the vertices and edges of shapes, and represent them using such materials as marshmallows and toothpicks, or straws and pipe cleaners.

Page 76 presents a more formal approach to the concept of a line segment. In considering a line segment, it must be kept in mind that segments are straight, not curved. The concept of straightness is probably best arrived at by observing the touching edges of solids, desks, books, tiles, and so on, and identifying lines which are not straight but curved. Insist that children use suitable straight edges in drawing line segments.

The teacher plays a significant role in questioning the children and leading them to investigate and discover for themselves.

cific properties of two-dimensional and three-dimensional
pes, and basic concepts of geometry. Additional stimulating
ivities should be provided for those who can profit from work
ond the basic lessons. Follow-up activities are suggested for
h lesson.

Materials

ups of two or three objects with likenesses and differences
dels of cubes, cylinders, cones, prisms, cuboids, pyramids,
pheres; objects suggesting these shapes

ared paper

outs of two-dimensional shapes illustrated on pages 72 and 73

y of the shape illustrated on page 74

aterials for constructing models of three-dimensional shapes

toothpicks, straws, marshmallows, pipe cleaners, plasticine,
lay)

arked straight edge for each child

Vocabulary

d	cylinder	face	triangle
e	cuboid	square	pentagon
e	pyramid	circle	hexagon
m	sphere	rectangle	octagon
e	point	line segment	vertex, vertices

LESSON OUTCOME

Identify likenesses and differences

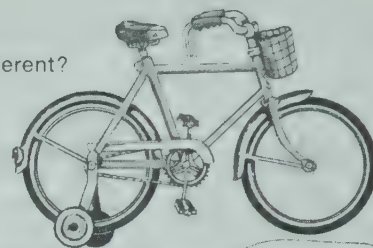
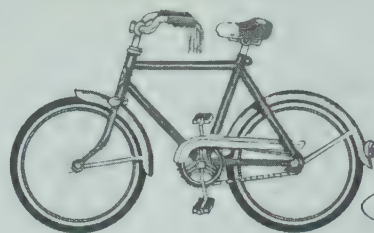
Materials

groups of two or three objects with likenesses and differences

4 GEOMETRY

Likenesses and Differences

How are these alike? How are they different?



Some people will say

They are all different.

They are all alike.
They are all bicycles.

Two of the bikes are alike.
They both have baskets.

Two of the bikes are alike.
They are both red.

The one bike is different.
It has training wheels.

Exercises

How are all three in each group alike?

How are two alike and the other different?

Answers will vary. Possible answers are given.

1. All three are animals.
Two are brown. One is white.



2. All three are foods. Two are peeled.
One is not peeled.



- 68 All three are used for sports.
Two have nets. One does not have a net.



- All three are shapes. One has a curved surface. Two do not have a curved surface.

LESSON ACTIVITY

Before Using the Pages

- Present two objects from the classroom and ask the children whether they are alike or different. Lead the children to conclude that the objects are alike in some ways and different in others. Discuss the likenesses and differences of other pairs of objects.
- Compare groups of two or three objects selected by children. Ask for the ways they are alike and the ways they are different.

Using the Pages

- Read the statements about the bicycles on the page. First discuss reasons for saying, "They are all alike. They are all bicycles." and, "They are all different." Lead the children to understand that each of these is partially true. Then find the bicycles referred to by the other statements.

Extend this by finding other ways the bicycles are alike or different. Then have the children compare the bicycles with their own.

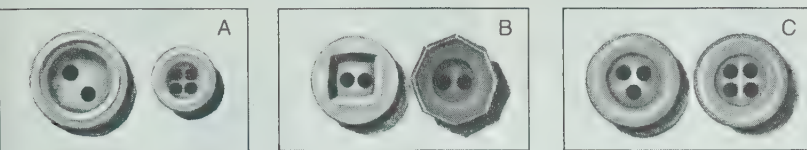
Exercises: Discuss Ex. 1. Lead the children to discover ways in which all three in each group are alike. Then direct discussion to have them realize that there are ways in which any two are alike and the other different. Ex. 1-4 are suited to oral discussion. You may wish to have children in one group or in small groups. Later the groups could share their answers.

Make sure the children understand how to complete the chart for Ex. 5.

Ex. 6-11 are more difficult. Again, it would be preferable to discuss these orally.

- To practice comparing, have the children find likenesses and differences in the pictures in Units 1-3 such as:
the banners on page 29;
the mattresses on page 40;
the clocks on pages 44-45;
the bicycles on page 67.

Copy the chart. Write "same" or "different" in each box.



	Buttons A	Buttons B	Buttons C
Shape	? same	? different	? same
Color	? different	? different	? same
Size	? different	? same	? same
Number of holes	? different	? same	? different

Do each of these. Answers will vary. Possible answers are given.

6. Tell one way Each has 7. Tell two ways They are 8. Tell three ways Each has
in which these three buttons in which these two-piece in which these a collar.
are alike. on the top. are alike. outfits. Each outfit are alike. Each top has a
has three pockets. pocket. They are two-
piece outfits.



9. Tell three ways 10. Tell two ways 11. Tell one way
in which these are different. in which these are different. in which these are different.



One has buttons on the top; the other has a zipper. One has a collar; the other does not. One has a belt; the other does not.

One has a belt; the other does not. The red band is curved on one, but not the other.

One top has three white buttons; the other top has four white buttons.

69

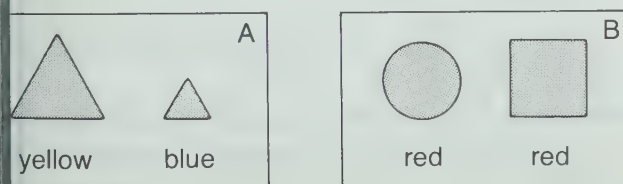
RELATED ACTIVITIES

- Set up a display table and board for this unit. Leave materials for subsequent lessons on the table to give the children an opportunity to explore and discover freely.
- To relate this lesson to the children's environment, have small groups explore likenesses and differences in concrete examples (fences, homes, road signs) and abstract examples (children's favorite sports, books, movies).
- A child may make a train of attribute pieces. (Attribute pieces can be made by preparing each of the shapes on pages T355 and T356 in red, blue, and yellow.) Each piece in the train differs from the next in one way (color, shape, or size).
- The game "Dominoes" on page T349 could be adapted so that an attribute piece can be placed next to another piece at either end of the line if it differs in one way from that piece.
- A child could select two attribute pieces at a time and record on a chart whether they are the same or different in color, shape, and size.
- Small groups of children could prepare charts by drawing objects and recording likenesses and differences. These could be displayed for interest and reinforcement.

Assessment

Use the chart and write "same" or "different" for each pair of

5.



	A	B
color	different	same
shape	same	different
size	different	same

LESSON OUTCOME

Recognize properties of solids, compare solids and objects with similar shapes (cube, cylinder, cone, prism, cuboid, pyramid, sphere)

Materials

models of cubes, cylinders, cones, prisms, cuboids, pyramids, and spheres; objects suggesting these shapes; scissors; tape; squared paper

Vocabulary

solids, cube, cylinder, cone, prism, cuboid, pyramid, sphere

Prerequisite Skills

Recognize likenesses and differences in the shapes of objects

Checking Prerequisite Skills

Write "same" or "different" for the shapes in each pair.

1.  same

2.  different

3.  same

Background

The term *solid* is used instead of *three-dimensional shape*.

LESSON ACTIVITY

Before Using the Pages

- Arrange to have models on display for a few days before the lesson. Encourage the children to experiment with them.
- Present objects and have the children select the solid each suggests. (There may be more than one for some objects.) Explore the likenesses and the differences of the object and the suggested solid.
- Present a solid and have the children find objects in the classroom with a similar shape. Explore the likenesses and the differences of the solid and the objects.

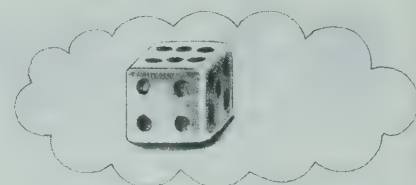
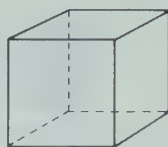
Using the Pages

- Explore the likenesses and the differences of the illustration of each solid, the corresponding picture, and the model.

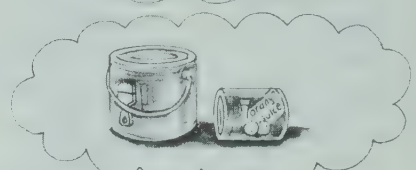
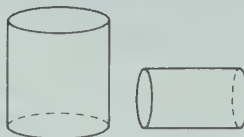
Solids

What objects do these shapes suggest?

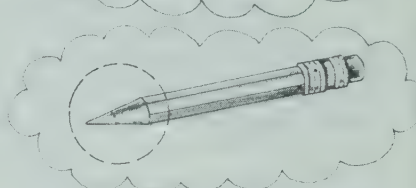
Cube



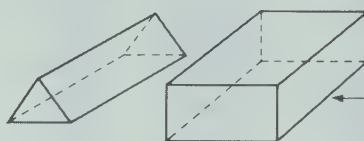
Cylinders



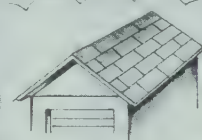
Cones



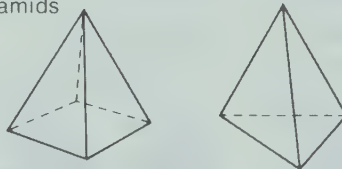
Prisms



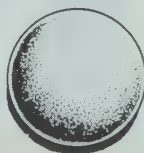
This prism is also called a **cuboid**.



Pyramids



Sphere



- Compare the names of the solids with objects as much as possible (cube, ice cube; cone, ice-cream cone; prism, actual prism; pyramid, picture of a pyramid). Compare cube and the cuboid.

Working Together: Have the children refer to page 70 for names of the solids, if necessary.

Exercises: For Ex. 10, discuss the example and ensure the children understand the directions. They may enjoy finding more than seven matches, and illustrating the objects.

- After they have completed the exercises, have the children give reasons for their choices. You may wish to extend the activity and have them describe differences between the objects and the solid.

- For reinforcement, have the children find and illustrate solids in Units 1-3. Some examples are: books on page 33; cans on page 4; canopy over the counter on page 11; shapes in Ex. 4 on page 68.

Working Together

What shapes do these objects suggest?

1. cone 

2. cube 

3. prism 

Exercises

What shapes do these objects suggest?

1. pyramid 

2. cylinder 

3. cone 

4. a hockey puck cylinder
5. a balloon sphere
6. a carrot cone
7. an orange sphere
8. a drinking straw cylinder
9. a railroad boxcar prism or cuboid

Choose one card from each group.

Sphere

Prism

Cylinder

Pyramid

Cube

Cone

can be played with

floats

rolls

opens

breaks


stacks, one on top of another

can be eaten




10. Try to name an object to match both cards.
Choose cards until you have made seven matches.
Answers will vary.

Sphere


breaks





Cut out a pattern like this.
Fold along the dotted lines.
The result is a cube.




Which of these patterns could you fold into a cube?

1. no 

2. yes 

3. yes 

4. Draw another pattern that could be folded into a cube. Several patterns are possible. One is given below.



try this

This: Compare a model of a cube with the illustration. Guide the children as they draw, cut, and form a cube. Emphasize that the sides of each square are the same length and that each pattern consists of six squares. Encourage the children to experiment with different ways of folding the patterns. The children could build a larger cube or a cuboid by stacking the cubes they make. Children would be pleased to have their cubes displayed as a mobile, used on the display table, or made into dice for a game.

Assessment

an object suggested by each of these solids.

- here 2. cube 3. cylinder 4. prism
- ne 6. pyramid 7. cuboid

Answers will vary.

RELATED ACTIVITIES

- Have the children bring examples of solids for the display.
- Have the children find and illustrate examples of solids in their environment.
- Have the children create solids in a variety of ways. They could use the patterns on pages T 357 and T 358 and construction paper, papier-mâché, plasticine, clay, toothpicks, straws, and pipe cleaners. These could be displayed as mobiles, put on the display table, or used as the materials for the next lesson.
- For reinforcing the properties of solids, have one child put a solid in a box without the others seeing it. Then they ask questions that can be answered by yes or no, such as: "Can it roll?" or "Is it a cube?" The child who identifies the solid correctly selects the next solid for discussion.
- Children could play the game "I Spy". One child says, "I spy an object that suggests a cone (or another solid)." The child who guesses the object is the next one to think of an object.
- To emphasize the shapes of solids, put one in a box so that it cannot be seen. Have a child reach in the box and identify it by touch.

LESSON OUTCOME

Recognize and illustrate likenesses and differences in the shapes of faces of solids (triangle, rectangle, square, pentagon, hexagon, octagon, circle)

Materials

the solids used for page 70, as many of the shapes drawn on pages 72 and 73 as possible

Vocabulary




face, triangle, rectangle, square, pentagon, hexagon, octagon, circle

Prerequisite Skills

Recognize likenesses and differences in the shapes of objects

Checking Prerequisite Skills

Write "same" or "different" for the shapes in each pair.

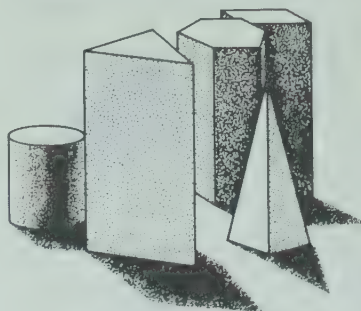
1.  same
2.  same
3.  different

Background

The term *face* is used instead of *two-dimensional shape*.

Faces and Their Shapes

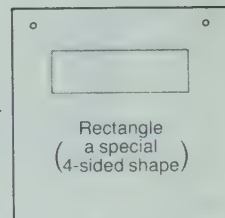
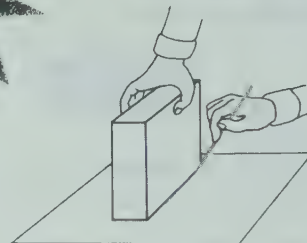
This prism has 6 faces.

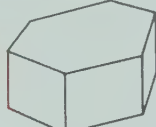
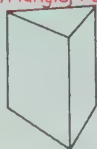
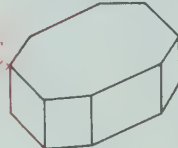
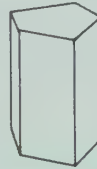


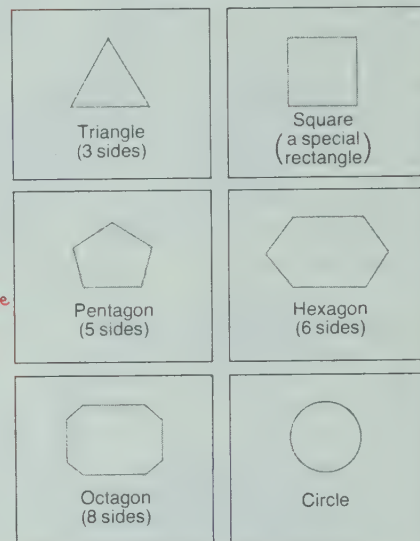
Working Together

Here is a way to show the shape of a face.

Which shapes would you get by drawing around each of these?



1.  hexagon, rectangle, square
2.  triangle, rectangle
3.  octagon, rectangle, square
4.  pentagon, rectangle



5. How are all triangles alike? 3 sides
6. How are squares different from hexagons?
7. Show how two pentagons could be different.
8. Show a four-sided shape that is not a rectangle.

6 Squares have 4 sides; hexagons have 6 sides.
72 Squares have square corners; hexagons do not necessarily have square corners.
Answers will vary for 7 and 8.

LESSON ACTIVITY

Before Using the Pages

- Introduce the term *face*. Have the children count the number of faces for a cube as you point to them. Mark the faces with chalk to indicate which ones are counted. Tell the children that a cube has six faces, and ask what they think "face" means.
- Have the children count the faces of solids having no curved surfaces. If possible, have them count the faces of a particular solid in different sizes. Emphasize that the number of faces is not affected by the size of the solid.
- Explore likenesses and differences of faces. Have the children trace outlines with their fingers and study the outlines. Ask how the faces are alike and how they are different.

Using the Pages

- Discuss the faces of the film box. Ask about the faces shown in each photograph.

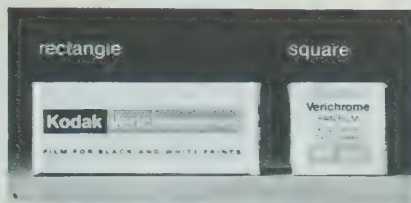
Compare likenesses and differences of the faces of film box. Discuss the information about the corners. Have the children point out rectangles they can see and determine which of these are squares.

Extend this to the solids at the top of page 72. Have children count the faces shown. Ask for the likenesses and the differences of the faces.




Working Together: Draw the children's attention to rectangle being drawn. Have a few children at a time draw faces of solids on the board.

Explore the likenesses and differences of the red shapes on page 72. Whenever possible, explain the meaning of prefix and relate it to other words (*tri*:- 3, tricycle, trip; *penta*:- 5; *hexa*:- 6; and *octa*:- 8, octopus).

Each face has the shape of a **rectangle**. Two of the rectangles have four equal sides. They are **squares**.



A rectangle has two pairs of equal sides.

It has corners like , and not like  or .

Exercises

Each of these shapes has four sides.



1. Which are rectangles? **A, B, D, E, F** 2. Which are squares? **A, D, E**

Draw pictures to show how

3. two triangles can be different. 4. two hexagons can be different.

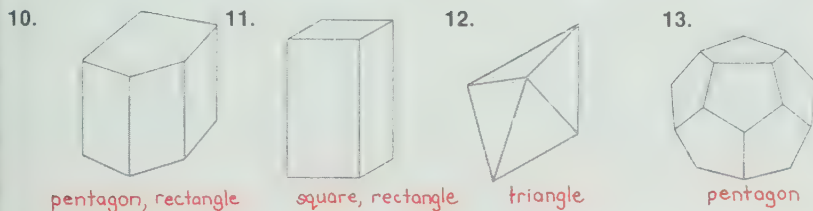
Look around. Name two objects you see that show the shape of

5. a triangle. 6. a rectangle. 7. a square.

Draw a picture

8. of an animal. Use only triangles and rectangles. 9. of a robot. Use each of the shapes at least once.

Name the shapes you see in the faces of each block.



pentagon, rectangle

square, rectangle

triangle

pentagon

73

RELATED ACTIVITIES

- Have children bring objects or pictures suggesting shapes for the display. Provide pictures for them to find and outline the faces.
- Have the children find examples of shapes in their environment.
- Have each child create shapes. They could glue toothpicks on paper, use geoboards, trace around the faces of solids, or use the shapes on pages T 355 and T 356 as patterns.
- One child could display an attribute piece prepared for page T 75. Another child names the shape.
- The attribute pieces may be used for a game in which all the pieces are placed on a table. One child selects an attribute piece. Another child points to another piece with the same shape. The color and size may differ.
- Children can create a mobile, a design, or a picture with different sizes of one shape or different shapes.
- To emphasize the meaning of faces, have children draw a funny face on each face of a solid.
- Provide opportunities for children to experiment with shapes to discover fitting them together as tiles and combining some to form others.

Assessment

1. Look around the classroom. Name two objects you see that show the shape of a circle.

Draw pictures to show how

2. two squares can be different.
3. two octagons can be different.

Answers will vary.

Have the children find examples in the classroom of each face. Ask for the likenesses and the differences of different examples of one shape.

Have the children do Ex. 1-6 orally and Ex. 7 and 8 on paper. Compare the different ways the children draw faces for Ex. 7 and 8. (They could vary the sizes of the angles, the lengths of the sides, or the positions of the shapes.)

Exercises: Remind the children to refer to the top of the page for Ex. 1 and 2. For Ex. 8 and 9, demonstrate what is expected by using circles to draw a picture on the board. For Ex. 10-13, tell them to refer to the red shapes on page 72 for the names, if necessary.

After they have completed the exercises, have the children share some of their answers. These types of exercises provide opportunities for individual thinking.

LESSON OUTCOME

Count vertices, edges, points, and line segments; relate vertices to points, and edges to line segments

Materials

toothpicks (straws), marshmallows (plasticine or clay), shapes made as shown on page 74

Vocabulary

line segment, edge, point, vertex, vertices

Prerequisite Skills

Count faces of solids

Checking Prerequisite Skills

(Display the solids named in brackets.)
Write the number of faces.

- 1. (cube) 6
- 2. (pyramid) 5(or 4)
- 3. (cuboid) 6

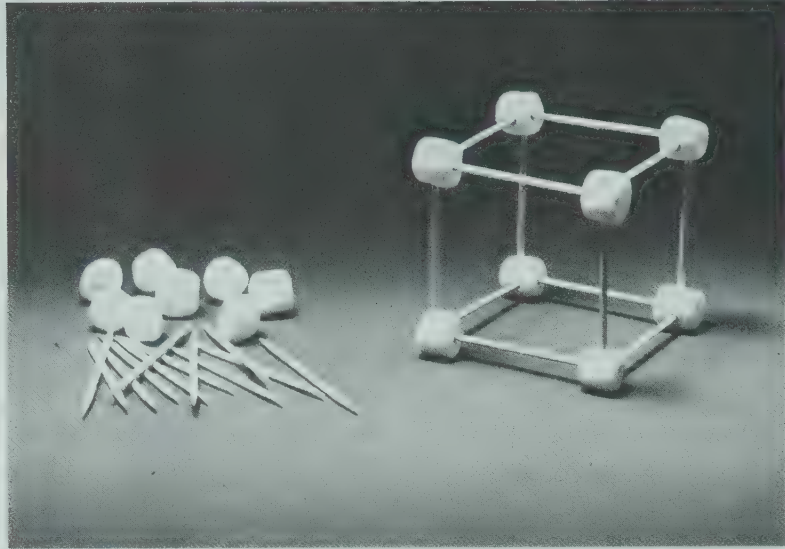
Background

A line is a straight path that continues without end. A line segment is a straight path that connects two points. The two points are called end points.

Edges and Vertices

12 toothpicks and 8 marshmallows can be put together to show the shape of a cube.

A cube has
12 edges and 8 vertices.



Working Together

You can draw a line segment for an edge.
You can draw a point for a vertex.

Example:



12 line segments show the edges of a cube.
8 points show the vertices of a cube.

How many points and how many line segments are in each shape?

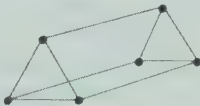
How many vertices, edges, and faces are in each shape?

1.



4 points
6 line segments

2.



6 points
9 line segments

3.



10 vertices
15 edges
7 faces

4.



5 vertices
8 edges
5 faces

LESSON ACTIVITY

Before Using the Pages

- Arrange to have the materials for the lesson available for children to explore and experiment before the lesson.
- Introduce the term *edge*. Display a pyramid having a base with 3 sides. Have the children count the edges as you point to them. Mark the edges with chalk to indicate which ones are counted. Tell them that this pyramid has 6 edges, and ask what they think “edge” means. Have them indicate and count the edges of other solids.

Use this procedure to introduce the term *vertices*.

Using the Pages

- Compare the photograph with an actual toothpick model and with a solid cube. Using the solid and the model, ask the children to verify the 12 edges, 8 vertices, and 6 faces by pointing to each in turn. Emphasize that the number of

vertices, edges, and faces is the same for the solid and model. Explore other likenesses and differences.

Working Together: Work through the explanations for and line segment, vertex and point, vertex and vertex.

Compare the drawing of a cube with the photograph. Emphasize that the number of edges, vertices, and faces is the same for each. Compare the illustrations with toothpick models to show that edges start at points only, not with a line segment appearing to cross another in an illustration.

Point out that the edges are different lengths, but can all be classified as long or short despite slight variations. For each illustration, ask for the number of long edges and the number of short edges.

Exercises: For Ex. 4-6, point out that the shapes are made in the same way as in the photograph, but with different materials. Remind the children about the different lengths of edges.

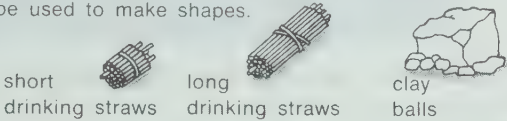
Exercises

Copy and complete the table.

	1.	2.	3.
Number of vertices	? 8	? 6	? 6
Number of edges	? 12	? 10	? 9
Number of faces	? 6	? 6	? 5

Straws and clay balls can be used to make shapes.

How many of each are needed to make these shapes?



7. These two pyramids can be joined to make a new shape. How many faces, edges, and vertices would be in the new shape?



8. How many faces, how many edges, how many vertices in this pyramid?



The answer depends on the number of sides in the base of the pyramid. See Using the Pages.

Add or subtract.

1. $\begin{array}{r} 6 \\ + 6 \\ \hline 12 \end{array}$	2. $\begin{array}{r} 11 \\ - 3 \\ \hline 8 \end{array}$	3. $\begin{array}{r} 9 \\ - 2 \\ \hline 11 \end{array}$	4. $\begin{array}{r} 10 \\ - 7 \\ \hline 3 \end{array}$	5. $\begin{array}{r} 8 \\ + 6 \\ \hline 14 \end{array}$	6. $\begin{array}{r} 11 \\ - 4 \\ \hline 7 \end{array}$
7. $\begin{array}{r} 2 \\ + 8 \\ \hline 10 \end{array}$	8. $\begin{array}{r} 15 \\ - 9 \\ \hline 6 \end{array}$	9. $\begin{array}{r} 5 \\ + 7 \\ \hline 12 \end{array}$	10. $\begin{array}{r} 14 \\ - 5 \\ \hline 9 \end{array}$	11. $\begin{array}{r} 7 \\ + 8 \\ \hline 15 \end{array}$	12. $\begin{array}{r} 14 \\ - 6 \\ \hline 8 \end{array}$
13. $\begin{array}{r} 8 \\ + 4 \\ \hline 12 \end{array}$	14. $\begin{array}{r} 13 \\ - 8 \\ \hline 5 \end{array}$	15. $\begin{array}{r} 8 \\ + 8 \\ \hline 16 \end{array}$	16. $\begin{array}{r} 13 \\ - 7 \\ \hline 6 \end{array}$	17. $\begin{array}{r} 9 \\ + 4 \\ \hline 13 \end{array}$	
18. $\begin{array}{r} 9 \\ + 7 \\ \hline 16 \end{array}$	19. $\begin{array}{r} 11 \\ - 5 \\ \hline 6 \end{array}$	20. $\begin{array}{r} 6 \\ + 4 \\ \hline 10 \end{array}$	21. $\begin{array}{r} 18 \\ - 9 \\ \hline 9 \end{array}$		

KEEPING SHARP

5 short drinking straws 5 short drinking straws 6 short drinking straws 7. 6 faces
4 long drinking straws 4 long drinking straws 3 long drinking straws 9 edges
6 clay balls 2 clay balls 6 clay balls 5 vertices

75

RELATED ACTIVITIES

- Have each child create shapes with toothpicks and plasticine. Have them make specific shapes with the illustrations in the text as models, with solids as models, and without models. Also, have them construct creations of their imagination. These can be displayed as mobiles. For more practice, have children count the edges, vertices, and faces of displayed shapes.
- Have the children count the edges and vertices of objects in their environment or of solids made with the patterns from pages T 357 and T 358.
- For reinforcement, prepare a work sheet showing shapes and instructions for counting the edges, vertices, and faces. Or extend this, and ask the children to draw shapes with a specific number of edges and vertices.
- You could adapt the game "I Spy" described on page T 77. Have the children give vertices and edges.
- The children could play the game on page T 77 for guessing solids hidden in a box, using their increased vocabulary.

Assessment

Copy and complete the chart.

Number of vertices	8	4
Number of edges	12	6
Number of faces	6	4

LESSON OUTCOME

Identify, draw, and compare line segments

Materials

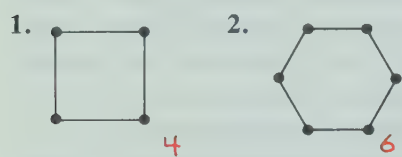
an unmarked straight edge for each child

Prerequisite Skills

Count line segments

Checking Prerequisite Skills

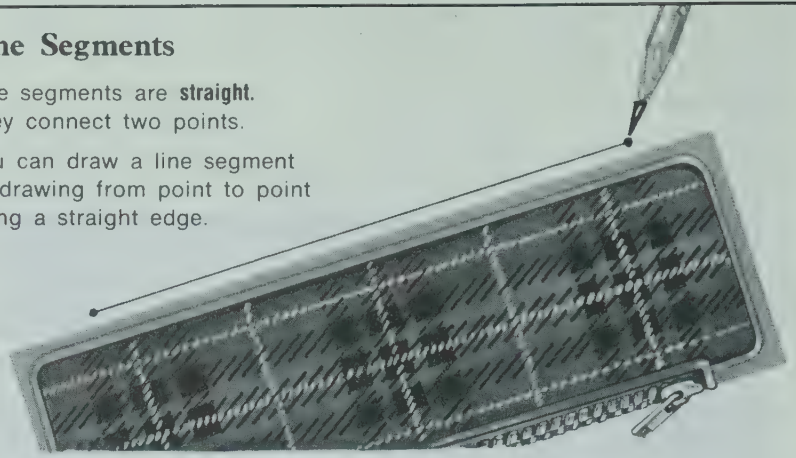
Write the number of line segments for each of the following.



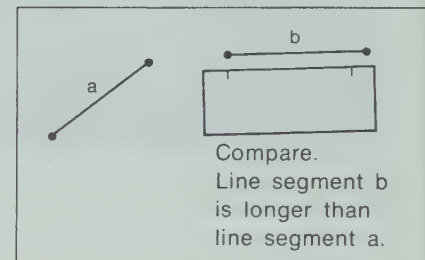
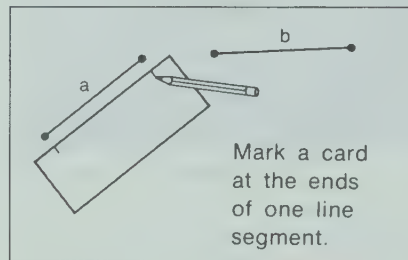
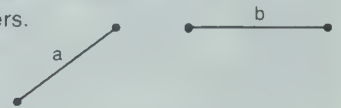
Line Segments

Line segments are **straight**.
They connect two points.

You can draw a line segment
by drawing from point to point
along a straight edge.



Some line segments are longer than others.
Here is a way to compare
line segments a and b.



Working Together **Answers will vary for 1 and 2.**

1. Draw two points.
Use the points and
a straight edge to
draw a line segment.
2. Draw three points.
Draw line segments
using two of the points
at a time as **end points**.



LESSON ACTIVITY

Before Using the Pages

- Review line segments and points. Have a child draw a shape on the board. Ask for the number of line segments and points. Repeat a few times.
- Explore the term *line segment*. Put examples that are not line segments on the board. Tell the children that each is not a line segment. Ask why. Lead the children to realize that line segments are straight, continuous between two points, and do not extend beyond the end points.

Using the Pages

- Read the information at the top of the page.
- Have the children estimate whether line segment *a* or *b* is longer, before the comparison is made.

Working Together: Have the children draw a few line segments for Ex. 1.

Introduce the term *end point*. Ask the children what they think “end point” means.

For Ex. 2, have children draw any three points and draw line segments to connect them. For Ex. 3, have the children estimate before measuring. They may enjoy putting up examples on the board, and experiencing the connection between the position of a line and the perception of length.

Exercises: For Ex. 9-12, emphasize connecting all the points.

Keeping Sharp: Review addition facts orally. Review the procedure for addition. Remind the children about adding with amounts of money. Also remind them about the need for regrouping in some, but not all, of the exercises.

Exercises

Is it a line segment or not?

1. *no*
2. *yes*
3. *no*
4. *no*

How many line segments are needed to show

5. a triangle? *3*
6. a square? *4*
7. a rectangle? *4*
8. a cube? *12*

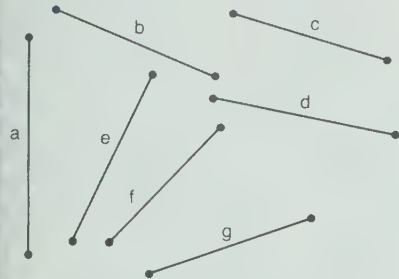
Draw sets of points as shown. Then draw line segments to connect the points in each set.



11. How many line segments can be drawn *in all* using 6 points? *6*
12. How many line segments can be drawn *in all* using 10 points? *10*

For the line segments shown below,

13. name three pairs that are the same length. *b,g*
c,f
d,e



14. Which of the above line segments is longest? *a*

Add.

1.
$$\begin{array}{r} 24 \\ + 35 \\ \hline 59 \end{array}$$
2.
$$\begin{array}{r} 53 \\ + 6 \\ \hline 59 \end{array}$$
3.
$$\begin{array}{r} 323 \\ + 25 \\ \hline 348 \end{array}$$
4.
$$\begin{array}{r} 345 \\ + 442 \\ \hline 787 \end{array}$$
5.
$$\begin{array}{r} 78 \\ + 8 \\ \hline 86 \end{array}$$
6.
$$\begin{array}{r} 37 \\ + 34 \\ \hline 71 \end{array}$$
7.
$$\begin{array}{r} 443 \\ + 39 \\ \hline 482 \end{array}$$
8.
$$\begin{array}{r} 655 \\ + 237 \\ \hline 892 \end{array}$$
9.
$$\begin{array}{r} 95 \\ + 14 \\ \hline 109 \end{array}$$
10.
$$\begin{array}{r} 222 \\ + 87 \\ \hline 309 \end{array}$$
11.
$$\begin{array}{r} 256 \\ + 491 \\ \hline 747 \end{array}$$
12.
$$\begin{array}{r} 584 \\ + 372 \\ \hline 956 \end{array}$$
13.
$$\begin{array}{r} 75 \\ + 98 \\ \hline 173 \end{array}$$
14.
$$\begin{array}{r} 676 \\ + 26 \\ \hline 702 \end{array}$$
15.
$$\begin{array}{r} 196 \\ + 397 \\ \hline 593 \end{array}$$
16.
$$\begin{array}{r} 486 \\ + 134 \\ \hline 620 \end{array}$$
17.
$$\begin{array}{r} 231 \\ + 269 \\ \hline 500 \end{array}$$
18.
$$\begin{array}{r} 499 \\ + 499 \\ \hline 998 \end{array}$$
19.
$$\begin{array}{r} \$6.03 \\ + 3.42 \\ \hline \$9.45 \end{array}$$
20.
$$\begin{array}{r} \$2.28 \\ + 6.64 \\ \hline \$8.92 \end{array}$$
21.
$$\begin{array}{r} \$3.87 \\ + 1.61 \\ \hline \$5.48 \end{array}$$
22.
$$\begin{array}{r} \$8.93 \\ + 0.87 \\ \hline \$9.80 \end{array}$$
23.
$$\begin{array}{r} \$4.95 \\ + 4.05 \\ \hline \$9.00 \end{array}$$

KEEPING SHARP

RELATED ACTIVITIES

- To emphasize that a line segment is the shortest distance between two points, select two end points in the classroom. Have a child walk along the line segment joining them, while others walk along different routes.
- If children require more practice using a straight edge, have them use one to create a design.
- Children could search for pictures with line segments and end points in magazines. They may color the line segments and ring the end points.
- Children could create and color patterns using shapes similar to those in Ex. 9 and 10.
- You could adapt the game "I Spy" on page T 77 for line segments or for end points.

Assessment

Draw 6 points. Draw line segments connecting the points. *Answers will vary.*

How many line segments are needed to show

- a. a pentagon? *5*
- b. a hexagon? *6*

OBJECTIVE

Demonstrate an understanding of the concepts and skills presented in this unit

RELATED ACTIVITIES

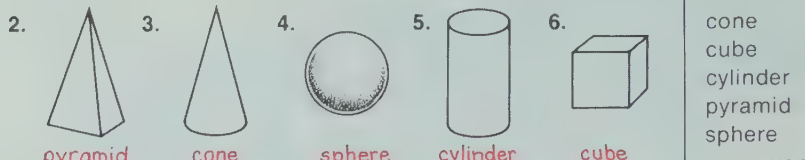
- A walk in the neighborhood would provide an opportunity to review and compare the concepts in this unit. Children could identify likenesses and differences in signs, plants, and buildings. They could find and compare examples of solids, faces, edges, vertices, and line segments.
- Children could create a collage showing concepts in this unit or discoveries made during a walk in the neighborhood.

Checking Up

Find the two pictures that are exactly alike.

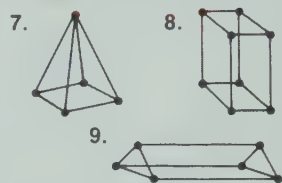


Choose a name from the list to match each shape.

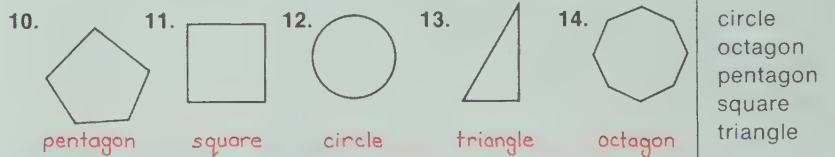


Copy and complete the chart for each shape.

	Number of faces	Number of vertices	Number of edges
7.	? 5	? 5	? 8
8.	? 6	? 8	? 12
9.	? 5	? 6	? 9



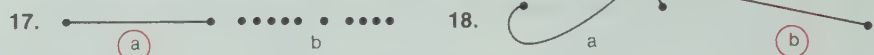
Choose a name from the list to match each shape.



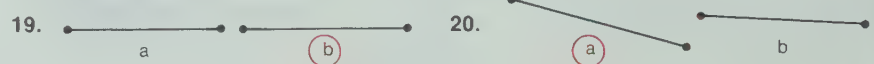
Use a straight edge and draw Answers will vary for 15 and 16.

15. a rectangle. 16. a hexagon.

In each pair, which picture shows a line segment?



Are the line segments in each pair the same length? no
If not, tell which is longer.



Skills	Exercises	Related Pages
Recognize likenesses	1	T 74-T 75
Match solids with their names	2-6	T 76-T 77
Count faces, vertices, and edges	7-9	T 80-T 81
Match shapes with their names	10-14	T 78-T 79
Draw shapes	15,16	T 78-T 79
Recognize line segments	17,18	T 82-T 83
Compare line segments	19,20	T 82-T 83

By having the children discuss the reasons for their answers for Ex. 17-20, you can check whether they understand the concepts involved.

Comments

If Ex. 7-9 present difficulties, have the children use models of the solids. If these exercises continue to be difficult, the children would benefit from opportunities to use the models as suggested in the *Related Activities* in Unit 4.

For Ex. 16, children tend to draw a regular hexagon. They may, however, enjoy varying the lengths of the six sides to create different hexagons.

OBJECTIVE

Recall addition and subtraction facts; add with regrouping

Materials

flash cards with addition or subtraction exercises similar to Ex. 1-27 on the front and the exercise and answer on the back

RELATED ACTIVITIES

- Children could use the flash cards as in the lesson or individually.
- The game "Concentration" for addition facts could be played with cards similar to the following.

$$2 + 4$$

$$6$$

- Cards similar to the following could be used for "Concentration" for subtraction facts.

$$12 - 7$$

$$5$$

- To review addition skills, prepare addition exercises with missing addends for children to solve.
- As a challenge, children could prepare addition squares for others to solve.

Checking Skills

Add.

1. $\begin{array}{r} 6 \\ +4 \\ \hline 10 \end{array}$	2. $\begin{array}{r} 3 \\ +9 \\ \hline 12 \end{array}$	3. $\begin{array}{r} 7 \\ +6 \\ \hline 13 \end{array}$
4. $\begin{array}{r} 8 \\ +8 \\ \hline 16 \end{array}$	5. $\begin{array}{r} 8 \\ +5 \\ \hline 13 \end{array}$	6. $\begin{array}{r} 5 \\ +7 \\ \hline 12 \end{array}$
7. $\begin{array}{r} 3 \\ +8 \\ \hline 11 \end{array}$	8. $\begin{array}{r} 9 \\ +7 \\ \hline 16 \end{array}$	9. $\begin{array}{r} 8 \\ +7 \\ \hline 15 \end{array}$
10. $\begin{array}{r} 8 \\ +4 \\ \hline 12 \end{array}$	11. $\begin{array}{r} 5 \\ +5 \\ \hline 10 \end{array}$	12. $\begin{array}{r} 9 \\ +9 \\ \hline 18 \end{array}$

Subtract.

13. $\begin{array}{r} 13 \\ -6 \\ \hline 7 \end{array}$	14. $\begin{array}{r} 16 \\ -7 \\ \hline 9 \end{array}$	15. $\begin{array}{r} 10 \\ -4 \\ \hline 6 \end{array}$
16. $\begin{array}{r} 12 \\ -7 \\ \hline 5 \end{array}$	17. $\begin{array}{r} 14 \\ -9 \\ \hline 5 \end{array}$	18. $\begin{array}{r} 15 \\ -7 \\ \hline 8 \end{array}$
19. $\begin{array}{r} 11 \\ -8 \\ \hline 3 \end{array}$	20. $\begin{array}{r} 12 \\ -6 \\ \hline 6 \end{array}$	21. $\begin{array}{r} 10 \\ -8 \\ \hline 2 \end{array}$
22. $\begin{array}{r} 12 \\ -4 \\ \hline 8 \end{array}$	23. $\begin{array}{r} 17 \\ -8 \\ \hline 9 \end{array}$	24. $\begin{array}{r} 11 \\ -7 \\ \hline 4 \end{array}$
25. $\begin{array}{r} 13 \\ -5 \\ \hline 8 \end{array}$	26. $\begin{array}{r} 13 \\ -9 \\ \hline 4 \end{array}$	27. $\begin{array}{r} 14 \\ -8 \\ \hline 6 \end{array}$

Add.

28. $\begin{array}{r} 24 \\ +13 \\ \hline 37 \end{array}$	29. $\begin{array}{r} 37 \\ +23 \\ \hline 60 \end{array}$	30. $\begin{array}{r} 375 \\ +74 \\ \hline 449 \end{array}$
31. $\begin{array}{r} \$1.45 \\ +1.79 \\ \hline \$3.24 \end{array}$	32. $\begin{array}{r} \$1.29 \\ +2.73 \\ \hline \$4.02 \end{array}$	

Add.

1. $\begin{array}{r} 9 \\ +6 \\ \hline 15 \end{array}$	2. $\begin{array}{r} 4 \\ +9 \\ \hline 13 \end{array}$	3. $\begin{array}{r} 3 \\ +7 \\ \hline 10 \end{array}$
4. $\begin{array}{r} 5 \\ +6 \\ \hline 11 \end{array}$	5. $\begin{array}{r} 7 \\ +7 \\ \hline 14 \end{array}$	6. $\begin{array}{r} 9 \\ +8 \\ \hline 17 \end{array}$
7. $\begin{array}{r} 8 \\ +6 \\ \hline 14 \end{array}$	8. $\begin{array}{r} 2 \\ +9 \\ \hline 11 \end{array}$	9. $\begin{array}{r} 9 \\ +5 \\ \hline 14 \end{array}$
10. $\begin{array}{r} 7 \\ +4 \\ \hline 11 \end{array}$	11. $\begin{array}{r} 6 \\ +6 \\ \hline 12 \end{array}$	12. $\begin{array}{r} 2 \\ +8 \\ \hline 10 \end{array}$

Subtract.

13. $\begin{array}{r} 15 \\ -6 \\ \hline 9 \end{array}$	14. $\begin{array}{r} 11 \\ -6 \\ \hline 5 \end{array}$	15. $\begin{array}{r} 10 \\ -9 \\ \hline 1 \end{array}$
16. $\begin{array}{r} 17 \\ -9 \\ \hline 8 \end{array}$	17. $\begin{array}{r} 12 \\ -8 \\ \hline 4 \end{array}$	18. $\begin{array}{r} 11 \\ -2 \\ \hline 9 \end{array}$
19. $\begin{array}{r} 16 \\ -8 \\ \hline 8 \end{array}$	20. $\begin{array}{r} 12 \\ -9 \\ \hline 3 \end{array}$	21. $\begin{array}{r} 14 \\ -5 \\ \hline 9 \end{array}$
22. $\begin{array}{r} 18 \\ -9 \\ \hline 9 \end{array}$	23. $\begin{array}{r} 12 \\ -5 \\ \hline 7 \end{array}$	24. $\begin{array}{r} 11 \\ -4 \\ \hline 7 \end{array}$
25. $\begin{array}{r} 13 \\ -7 \\ \hline 6 \end{array}$	26. $\begin{array}{r} 15 \\ -8 \\ \hline 7 \end{array}$	27. $\begin{array}{r} 13 \\ -8 \\ \hline 5 \end{array}$

Add.

28. $\begin{array}{r} 146 \\ +43 \\ \hline 189 \end{array}$	29. $\begin{array}{r} 204 \\ +258 \\ \hline 462 \end{array}$	30. $\begin{array}{r} 382 \\ +134 \\ \hline 516 \end{array}$
31. $\begin{array}{r} \$2.57 \\ +0.58 \\ \hline \$3.15 \end{array}$	32. $\begin{array}{r} \$4.67 \\ +1.79 \\ \hline \$6.46 \end{array}$	

SSON ACTIVITY

ore Using the Page

review addition and subtraction facts. Divide the children into small groups and give flash cards to a leader of each group to display for the others. The child who answers correctly takes the card. The child with the most cards becomes the next leader. (This gives you the opportunity to move among the groups and note any child requiring more practice.)

review the addition skills with regrouping. Ask the children when they add outside of school. Give examples of addition requiring regrouping related to these uses. Include examples of addition with amounts of money.

Using the Page

- Remind the children to read the instructions and signs.
- Emphasize speed and accuracy. Practicing addition and subtraction facts quickly, and without using counters, is important at this level of learning skills.
- To give you a more accurate assessment of the children's skill and to provide variety for the children, assign each of the two sections at a different time. After each section, you could use one of the activities or games.

Unit 5 Overview

Subtraction

The primary objective of this unit is to develop skill in the subtraction of three-digit numbers with regrouping. To help accomplish this, much of the teaching process is oriented towards activities that can lead children to a better understanding of the mathematical concepts which underlie the standard algorithm.

The initial pages review the concept of subtraction with exercises that involve no regrouping. As with addition in Unit 3, regrouping is presented in three stages. Children deal first with exercises that require only regrouping tens as ones. Next, only exercises that require regrouping hundreds as tens are presented. Finally, exercises that require both regroupings are encountered. This step-by-step approach provides for exercises that become gradually more challenging as the unit progresses and enables children to build on a skill learned previously. As the unit closes, exercises are explored for which the minuend has zero tens. Then subtraction is applied to problems involving sums of money.

Prerequisite Skills

- complete the basic subtraction facts

Unit Outcomes

- subtract with up to two regroupings, minuends to 999
- subtract amounts of money with regrouping, minuends to \$9.99
- solve word problems involving subtraction
- solve problems in two steps

Background

Addition and subtraction are inverse operations; what one "does", the other "undoes". The effect of adding five, for example, is "undone" by subtracting five, and the effect of subtracting two is "undone" by adding two.

$3 + 5 = 8 \iff 8 - 5 = 3$ $6 - 2 = 4 \iff 4 + 2 = 6$
This relationship is useful in that addition can be performed to check that the difference in a subtraction is correct.

$$\begin{array}{r} 62 \\ - 35 \\ \hline 27 \end{array} \quad \begin{array}{r} 27 \\ + 35 \\ \hline 62 \end{array}$$

Since subtraction and addition are inverse operations, many of the concepts and skills which have been developed for addition in previous units are applicable to the work with subtraction in this unit. Patterns of basic facts may be used for subtracting numbers in higher decades. Extensions may be useful in subtracting one-digit numbers from two-digit numbers. For example, $76 - 4 = 72$, $86 - 4 = 82$ are extensions of $6 - 4 = 2$, and $62 - 5 = 57$, $72 - 5 = 67$ are extensions of $12 - 5 = 7$. Extensions in subtraction, however, are not as important as in addition, especially in column addition where unseen addends are encountered. In subtraction it is possible to use regrouping and, although it is used in an inverse manner to that used in addition with regrouping, the same basic principle of renaming ten ones as one ten is involved in renaming one ten as ten ones.

Subtraction with regrouping is the major objective of this unit. While children have met subtraction many times before, this

may be the first time the concept of regrouping in subtraction taught formally. In preparation, children need practice expressing three-digit numbers as hundreds, tens, and ones, and renaming the numbers to show 10 more ones and/or 10 more tens. For example,

$$\begin{aligned} 172 &= 1 \text{ hundred } 7 \text{ tens } 2 \text{ ones} \\ &= 1 \text{ hundred } 6 \text{ tens } 12 \text{ ones} \\ 534 &= 5 \text{ hundreds } 3 \text{ tens } 4 \text{ ones} \\ &= 4 \text{ hundreds } 13 \text{ tens } 4 \text{ ones} \\ 316 &= 3 \text{ hundreds } 1 \text{ ten } 6 \text{ ones} \\ &= 3 \text{ hundreds } 0 \text{ tens } 16 \text{ ones} \\ &= 2 \text{ hundreds } 10 \text{ tens } 16 \text{ ones} \end{aligned}$$

Recall that the standard form for a number, such as 172, shows no more than 9 in any place (hundreds, tens, ones, in this case). In subtraction it is often necessary to regroup a minuend to show more than 9 in any place. The regrouping example shown above, for instance, would be applied in the following subtractions.

$$\begin{array}{r} 612 \\ - 58 \\ \hline 114 \end{array} \quad \begin{array}{r} 413 \\ - 192 \\ \hline 342 \end{array} \quad \begin{array}{r} 2016 \\ - 247 \\ \hline 69 \end{array}$$

It is important to note that the operation of subtraction is not commutative. That is, changing the order of two (unequal) numbers will change the difference. For example, $6 - 2 = 4$ becomes $2 - 6 = -4$ if the minuend and subtrahend are interchanged. In the second subtraction sentence, the difference -4 , is not a whole number. Children who do not have a good understanding of place value and regrouping among the places tend to change the order of two digits mentally and subtract. For instance, for $42 - 17$, they tend to think, "Seven ones subtracted from two ones is five ones" rather than, "Seven ones cannot be subtracted from two ones, so forty-two must be regrouped three tens twelve ones." Further practice may be needed to strengthen the basic concept of subtraction as "taking away some or all the members of a set. This implies, then, that if there are two objects in a set, it is not possible to take away seven objects from the set. Similarly, the phrase $2 - 7$ is not a name for a whole number.

Many children experience difficulty with regrouping in subtraction when the minuend has zero tens as in $403 - 16$. Subtractions similar to this have frequently been carried out using two regroupings. That is, 4 hundreds 0 tens 3 ones regrouped as 3 hundreds 10 tens 3 ones, and this is regrouped as 3 hundreds 9 tens 13 ones. The approach recommended in this text suggests that three-digit numbers with zero tens be thought of in terms of tens and ones only, for such exercises. For example, 403 can be thought of as 40 tens 3 ones and regrouped as 39 tens 13 ones (A). For multiples of one hundred, 500, for example, can be thought of as 50 tens 0 ones, and regrouped as 49 tens 10 ones (B).

$$\begin{array}{r} 3913 \\ \text{A } 403 \\ - 165 \\ \hline 238 \end{array} \quad \begin{array}{r} 4910 \\ \text{B } 500 \\ - 287 \\ \hline 213 \end{array}$$

This approach to regrouping three-digit numbers with zero tens was first introduced in Unit 2 on page 30.

As with addition, it should be emphasized that subtraction is performed in a right-to-left order beginning with the ones, then

tens, and so on. In this way, it is possible to determine whether regrouping will be necessary before the subtraction can be carried out.

Subtraction with regrouping is applied to work with amounts of money for dollars, dimes, and pennies. One dollar may be changed for ten dimes, and one dime may be exchanged for ten pennies. In this way the concept of hundreds, tens, and ones is reinforced.

Teaching Strategies

The unit begins with the subtraction of two-digit and one-digit numbers with no regrouping. The children will likely have little difficulty with this topic because the basic subtraction facts having minuends to 9 that are used with ones are also used with tens and hundreds. Review that subtraction is the operation that can be associated with the removal of objects from a set. Children need to understand that the number of objects taken away is equal to or less than the number of objects in the set, and, correspondingly, that a number which is subtracted must be less than or equal to the number from which it is being subtracted. This concept and that of place value are applied when two numbers are to be arranged in vertical form for subtraction, such as,

$$\begin{array}{r} \text{Subtract 122 from 354.} \qquad 354 \\ - 122 \\ \hline \end{array}$$

For subtraction with regrouping, it is important to use the place value models and charts for hundreds, tens, and ones as were used for regrouping in addition. In this way children can see the similarities between the two operations, although regrouping is done inversely. The base-ten Multibase Arithmetic Blocks,ifix cubes, or informal objects such as bundles of sticks can be used extensively in the early stages. At the same time, place-value pocket charts and abacus charts can be used to show the steps to record the steps in the procedure. Abacus charts are particularly useful if covered with acetate so that the children can write on them with special markers and clean and reuse them repeatedly. Place-value pocket charts are useful in checking on children's understanding and skills in working with numbers.

For subtraction with amounts of money, some children may find it less confusing to write the exercises without the dollar symbol and the decimal, complete the exercises, and then write the symbols in their places. For less capable children, you may prefer to delay the topic of subtraction with zero tens in the minuend until a later date. This will allow more time for developing the skill in using the subtraction algorithm for one and two regroupings without involving zero tens. Practice is provided in this unit. However, like any other skill, subtraction with regrouping must be reviewed and practiced from time to time throughout the year. Some of this additional practice is provided in subsequent units through the features "Keeping Sharp" and "Checking Skills".

Materials

Play map of Canada
Models for hundreds, tens, and ones for each child
or play money (dollars, dimes, pennies)
Objects available in the classroom for sets

Vocabulary

graph

LESSON OUTCOME

Subtract numbers without regrouping, minuends to 999

Materials

models for 9 hundreds, 9 tens, and 9 ones for each child

Prerequisite Skills

Complete basic subtraction facts, minuends to 9

Checking Prerequisite Skills

Subtract.

1. 6
 - 3

 3

2. 4
 - 4

 0

3. 9
 - 7

 2

4. 7
 - 6

 1

5. 8
 - 5

 3

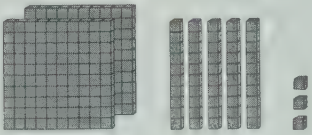
6. 2
 - 0

 2

5 SUBTRACTION

No Regrouping

Subtract 132 from 253.



hundreds

tens

ones

$$\begin{array}{r} 253 \\ -132 \\ \hline \end{array}$$

Show 253 and 132 with their hundreds, tens, and ones lined up. Show the greater number first.

$$\begin{array}{r} 253 \\ -132 \\ \hline 1 \end{array}$$

Subtract the ones.

$$\begin{array}{r} 253 \\ -132 \\ \hline 21 \end{array}$$

Subtract the tens.

$$\begin{array}{r} 253 \\ -132 \\ \hline 121 \end{array}$$

Subtract the hundreds.

253 minus 132 equals 121.

LESSON ACTIVITY

Before Using the Pages

- Introduce separating groups of models to represent subtraction in the following way. Have the children represent fifty-seven with their models. Ask for and record the number of ones, and then the number of tens on a place-value chart as shown. Write the subtrahend on the chart and ask what number is represented by 2 tens 1 one. Have the children remove models to represent subtracting the ones. Ask for and record the difference in the ones' place. Repeat this for subtracting the tens. Ask for the number represented by 3 tens 6 ones. Write the numeral below the chart.

tens	ones	
5	7	(minuend)
- 2	1	(subtrahend)
3	6	(difference)

36

(Note that the words *minuend* and *subtrahend* are usually not used with the children.)

Use this method for 457-236 and then for 698-290

Using the Pages

- See the *Note* on page T 52 for an explanation of how examples are shown with models throughout this book. Have children examine how the illustrations of models, the numbers on the numerals, and the instructions are coordinated in each step of the worked example. The explanation emphasizes that the hundreds, tens, and ones are lined up and that the ones are subtracted first, then the tens, and then the hundreds. Remind the children that the greater number is written at the top and that the lesser number is subtracted from the greater number.
- Ask a few children to explain the method of subtraction in their own words.

Working Together

Line up the hundreds, tens, and ones in vertical form.

$$\begin{array}{r} 365 \\ -215 \\ \hline \end{array}$$

$$\begin{array}{r} 258 \\ -43 \\ \hline \end{array}$$

Follow the steps.

$$\begin{array}{r} 467 \\ -137 \\ \hline 330 \end{array}$$

Subtract ones.
 Subtract tens.
 Subtract hundreds.

Subtract.

$$4. 603 - 102 \quad 5. 123 - 12$$

$$\begin{array}{r} 88 \\ -57 \\ \hline 31 \end{array}$$

$$\begin{array}{r} 465 \\ -253 \\ \hline 212 \end{array}$$

Exercises

Show the numbers in vertical form and subtract.

$$1. 73 - 21 \quad 2. 85 - 40 \quad 3. 79 - 5 \quad 4. 94 - 34 \quad 5. 168 - 123 \quad 6. 659 - 432 \quad 7. 928 - 305 \quad 8. 732 - 32$$

Subtract.

$$\begin{array}{r} 9. 858 \\ -322 \\ \hline 536 \end{array}$$

$$\begin{array}{r} 10. 676 \\ -53 \\ \hline 623 \end{array}$$

$$\begin{array}{r} 11. 66 \\ -42 \\ \hline 24 \end{array}$$

$$\begin{array}{r} 12. 398 \\ -368 \\ \hline 30 \end{array}$$

$$\begin{array}{r} 13. 58 \\ -4 \\ \hline 54 \end{array}$$

$$\begin{array}{r} 14. 344 \\ -220 \\ \hline 124 \end{array}$$

$$\begin{array}{r} 15. 649 \\ -136 \\ \hline 513 \end{array}$$

$$\begin{array}{r} 16. 272 \\ -51 \\ \hline 221 \end{array}$$

$$\begin{array}{r} 17. 738 \\ -136 \\ \hline 602 \end{array}$$

$$\begin{array}{r} 18. 989 \\ -851 \\ \hline 138 \end{array}$$

$$\begin{array}{r} 19. 65 \\ -35 \\ \hline 30 \end{array}$$

$$\begin{array}{r} 20. 894 \\ -254 \\ \hline 640 \end{array}$$

$$\begin{array}{r} 21. 854 \\ -22 \\ \hline 832 \end{array}$$

$$\begin{array}{r} 22. 67 \\ -66 \\ \hline 1 \end{array}$$

$$\begin{array}{r} 23. 689 \\ -613 \\ \hline 76 \end{array}$$

$$\begin{array}{r} 24. 95 \\ -44 \\ \hline 51 \end{array}$$

$$\begin{array}{r} 25. 958 \\ -7 \\ \hline 951 \end{array}$$

$$\begin{array}{r} 26. 781 \\ -741 \\ \hline 40 \end{array}$$

$$\begin{array}{r} 27. 923 \\ -601 \\ \hline 322 \end{array}$$

$$\begin{array}{r} 28. 222 \\ -111 \\ \hline 111 \end{array}$$

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RELATED ACTIVITIES

- Children may work in groups so that one child writes a subtraction exercise and each child shows the subtraction using a different one of the following methods: the models used in this lesson; bundles of sticks; an abacus; a place-value chart and cutouts from page T361 as models for hundreds, tens, and ones. After the children complete each subtraction exercise have them compare answers.
- Work sheets with charts similar to the following may be used for practice and for review of the place-value aspect of subtraction. The bottom right block provides a check. (Ensure that the additions do not require regrouping.)

	Add →		
Subtract ↓	600	30	7
	200	10	5
	400		

Working Together: Review the meaning of “vertical form” and ask why it is used. Have the children write Ex. 4 and 5 in vertical form before subtracting. Give more examples including some that require lining up a minuend and a subtrahend with different numbers of digits.

Exercises: Remind the children to write Ex. 1-8 in vertical form and to subtract the ones, then the tens, and then the hundreds. For exercises such as Ex. 23, the standard practice is not to write zero at the left of the difference. You may wish to provide a few similar subtraction exercises before assigning the exercises.

After the children have completed the exercises, they could consider the place value of the digits. For example, they would explain the steps in Ex. 9 as follows: 8 ones minus 2 ones equals 6 ones; 5 tens minus 2 tens equals 3 tens; 8 hundreds minus 3 hundreds equals 5 hundreds; 858 minus 322 equals 536.

Assessment

Subtract.

$$\begin{array}{r} 1. 748 \\ -325 \\ \hline 423 \end{array}$$

$$\begin{array}{r} 2. 275 \\ -40 \\ \hline 235 \end{array}$$

$$\begin{array}{r} 3. 584 \\ -524 \\ \hline 60 \end{array}$$

$$4. 613 - 2$$

LESSON OUTCOME

Subtract with regrouping tens as ones, minuends to 999

Materials

models for 9 hundreds, 9 tens, and 18 ones for each child

Prerequisite Skills

Complete basic subtraction facts

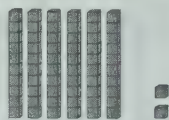
Checking Prerequisite Skills

Subtract.

1. $\begin{array}{r} 17 \\ - 8 \\ \hline 9 \end{array}$
2. $\begin{array}{r} 18 \\ - 9 \\ \hline 9 \end{array}$
3. $\begin{array}{r} 16 \\ - 7 \\ \hline 9 \end{array}$
4. $\begin{array}{r} 11 \\ - 3 \\ \hline 8 \end{array}$
5. $\begin{array}{r} 9 \\ - 7 \\ \hline 2 \end{array}$
6. $\begin{array}{r} 15 \\ - 8 \\ \hline 7 \end{array}$

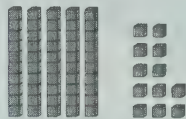
Subtraction, Regrouping Tens to Ones

Subtract 34 from 62.



$$\begin{array}{r} 62 \\ - 34 \\ \hline \end{array}$$

Show $62 - 34$ in vertical form.

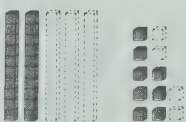


$$\begin{array}{r} 5 \quad 12 \\ \cancel{6} \quad 2 \\ - 3 \quad 4 \\ \hline \end{array}$$

Cannot subtract 4 ones from 2 ones. Regroup 6 tens, 2 ones as 5 tens, 12 ones.

$$\begin{array}{r} 5 \quad 12 \\ \cancel{6} \quad 2 \\ - 3 \quad 4 \\ \hline 2 \quad 8 \end{array}$$

Subtract the ones.



$$\begin{array}{r} 5 \quad 12 \\ \cancel{6} \quad 2 \\ - 3 \quad 4 \\ \hline 2 \quad 8 \end{array}$$

Subtract the tens.

34 subtracted from 62 is 28.

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LESSON ACTIVITY

Before Using the Pages

- Use models for hundreds, tens, and ones. Have each child display 4 tens. Ask what number this represents. Point out that there are 4 tens but no ones. Write the numeral on a place-value chart as you say that 4 tens is a name for forty.

Ask the children to find a way to represent forty using only 3 tens. Lead them to realize that 1 ten can be regrouped as 10 ones. Have the children regroup the models by replacing one model for tens with models for 10 ones. Record the regrouping on the chart as shown and explain that 3 tens 10 ones is another name for forty.

tens	ones
3	10
4	0

Use a similar procedure for 56, 120, and then 172.

Using the Pages

- The illustrations of models, the red on the numerals, and instructions are coordinated to show each step of worked example. Review that the ones are subtracted first. Lead the children to realize that since 4 ones cannot be subtracted from 2 ones, 1 ten of the 6 tens must be regrouped as 10 ones. Emphasize that 1 ten is regrouped as 10 ones only when it is necessary for subtracting the ones. Explain that the regrouped number is the number used for subtracting. Ask why the ones are subtracted before the tens. Develop that before subtracting the tens, it is necessary to determine whether a ten must be regrouped as ones.
- Ask the children to express the statement at the bottom of page 82 in another way. Refer to the statement at the bottom of page 80.

Working Together

Follow the steps.

1.
$$\begin{array}{r} 63 \\ -28 \\ \hline \end{array}$$

← Regroup
6 tens, 3 ones as
5 tens, 13 ones.

$\begin{array}{r} 5\ 13 \\ -28 \\ \hline 35 \end{array}$

Subtract
8 ones from 13 ones.

Subtract
2 tens from 5 tens.

2.
$$\begin{array}{r} 91 \\ -65 \\ \hline \end{array}$$

← Regroup to show
one less ten and
10 more ones.

$\begin{array}{r} 8\ 11 \\ -65 \\ \hline 26 \end{array}$

Subtract ones.

Subtract tens.

Subtract.

3.
$$\begin{array}{r} 55 \\ -9 \\ \hline 46 \end{array}$$

4.
$$\begin{array}{r} 80 \\ -56 \\ \hline 24 \end{array}$$

5.
$$\begin{array}{r} 237 \\ -28 \\ \hline 209 \end{array}$$

6.
$$\begin{array}{r} 763 \\ -206 \\ \hline 557 \end{array}$$

Exercises

Subtract.

1. $91 - 73$ 18

2. $15 - 7$ 8

3. $76 - 34$ 42

4. $351 - 28$ 323

5. $664 - 415$ 249

6. $61 - 37$ 24

7. $882 - 503$ 379

8. $82 - 76$ 6

9.
$$\begin{array}{r} 42 \\ -24 \\ \hline 18 \end{array}$$

10.
$$\begin{array}{r} 27 \\ -9 \\ \hline 18 \end{array}$$

11.
$$\begin{array}{r} 880 \\ -65 \\ \hline 815 \end{array}$$

12.
$$\begin{array}{r} 77 \\ -43 \\ \hline 34 \end{array}$$

13.
$$\begin{array}{r} 73 \\ -25 \\ \hline 48 \end{array}$$

14.
$$\begin{array}{r} 891 \\ -836 \\ \hline 55 \end{array}$$

15.
$$\begin{array}{r} 90 \\ -27 \\ \hline 63 \end{array}$$

16.
$$\begin{array}{r} 94 \\ -9 \\ \hline 85 \end{array}$$

17.
$$\begin{array}{r} 245 \\ -18 \\ \hline 227 \end{array}$$

18.
$$\begin{array}{r} 74 \\ -36 \\ \hline 38 \end{array}$$

19.
$$\begin{array}{r} 94 \\ -62 \\ \hline 32 \end{array}$$

20.
$$\begin{array}{r} 671 \\ -154 \\ \hline 517 \end{array}$$

21.
$$\begin{array}{r} 66 \\ -48 \\ \hline 18 \end{array}$$

22.
$$\begin{array}{r} 83 \\ -19 \\ \hline 64 \end{array}$$

23.
$$\begin{array}{r} 827 \\ -112 \\ \hline 715 \end{array}$$

24.
$$\begin{array}{r} 453 \\ -17 \\ \hline 436 \end{array}$$

25.
$$\begin{array}{r} 75 \\ -6 \\ \hline 69 \end{array}$$

26.
$$\begin{array}{r} 474 \\ -365 \\ \hline 109 \end{array}$$

27.
$$\begin{array}{r} 50 \\ -43 \\ \hline 7 \end{array}$$

28.
$$\begin{array}{r} 873 \\ -404 \\ \hline 469 \end{array}$$

83

RELATED ACTIVITIES

- Since it is important for children to experiment with different models to understand regrouping, adapt the first activity described on page T89, but present exercises that require regrouping tens as ones.
- For reviewing basic subtraction facts, prepare a work sheet with subtraction puzzles similar to the following. Instruct the children to subtract across and down. The bottom right block provides a check.

→

↓

17	9	
8	5	

→

↓

16	8	
7	6	

- Cutouts from page T361 may be used as models for hundreds, tens, and ones. Children may paste these on a chart to illustrate a subtraction with regrouping 1 ten as 10 ones. The charts may be displayed to provide an example for reference.

Working Together: Have the children discuss the importance of following the steps outlined for Ex. 1 and 2. Have them state these steps as they complete Ex. 3-6. Provide examples that require lining up the numerals in vertical form before subtracting. Lead the children to realize that the vertical form facilitates subtracting and regrouping.

Exercises: Have the children write Ex. 1-8 in vertical form. Some children may benefit from using their models to check the regrouping.

Assessment

Subtract.

$$\begin{array}{r} 48 \\ -29 \\ \hline 19 \end{array}$$

2.
$$\begin{array}{r} 480 \\ -23 \\ \hline 457 \end{array}$$

$$\begin{array}{r} 523 \\ -514 \\ \hline 9 \end{array}$$

4.
$$\begin{array}{r} 761 \\ -9 \\ \hline 752 \end{array}$$

T91

OBJECTIVE

Demonstrate competence in subtracting without regrouping and with regrouping tens as ones, minuends to 999; solve related word problems

Practice

Trains are made up in a railroad sorting yard.

1. 289 boxcars. 62 taken for a train. How many boxcars are left? **227**

3. 23 cabooses. 9 trains take one caboose each. How many cabooses are left? **14**

5. 68 cars are being sorted by a switch engine. It puts 29 on one track. How many are left to be sorted? **39**

*7. 76 grain cars are needed. 25 are on one track. 28 are on another track. How many more are needed? **23**
2. 90 cars in a train. 62 are boxcars. How many are not boxcars? **28**

4. 50 cattle cars. 22 are loaded. How many are empty? **28**

6. 389 autos to load onto car carriers. There are spaces for just 276. How many autos cannot be loaded? **113**

*8. 963 cars in the yard. 545 taken out one day. 319 come in that day. How many cars are there at the end of the day? **737**



84

LESSON ACTIVITY

Using the Pages

- The photograph could motivate a discussion about trains and the children’s experiences with trains. This discussion could be used to introduce the word problems. Either before or after the children complete the exercises on the page, the photograph could be used to encourage the children to create word problems involving subtraction for other children to solve. You should change the numbers if they involve minuends greater than 999, and if they require regrouping from hundreds to tens.
- For Ex. 1-8, remind the children to show the subtraction in vertical form and answer the question in a sentence. Some children may require help in understanding the different steps used to solve the problems in Ex. 7 and 8 which are starred because they require more than one step in the solution. Have the children write Ex. 9-16 in vertical form.

- After the children have completed Ex. 9-36, they may benefit from selecting exercises that do not require regrouping and explaining why regrouping is not necessary. They may also benefit from selecting exercises that require regrouping and discussing the reason for regrouping. Determine whether difficulties arise from the inability to recall subtraction facts or from a lack of understanding of regrouping 1 ten as 10 ones. Provide practice as needed.
- Try This: Ensure that the children understand the steps. Children may wish to try more than five examples. Provide an opportunity for discussing the results.

Subtract.

- | | | | |
|--|---|---|---|
| 9. $73 - 49$ 24 | 10. $45 - 4$ 41 | | |
| 11. $67 - 46$ 21 | 12. $384 - 28$ 356 | | |
| 13. $61 - 5$ 56 | 14. $867 - 523$ 344 | | |
| 15. $680 - 348$ 332 | 16. $688 - 62$ 626 | | |
| 17. $\begin{array}{r} 91 \\ - 37 \\ \hline 54 \end{array}$ | 18. $\begin{array}{r} 299 \\ - 57 \\ \hline 242 \end{array}$ | 19. $\begin{array}{r} 33 \\ - 8 \\ \hline 25 \end{array}$ | 20. $\begin{array}{r} 90 \\ - 36 \\ \hline 54 \end{array}$ |
| 21. $\begin{array}{r} 472 \\ - 35 \\ \hline 437 \end{array}$ | 22. $\begin{array}{r} 89 \\ - 4 \\ \hline 85 \end{array}$ | 23. $\begin{array}{r} 545 \\ - 341 \\ \hline 204 \end{array}$ | 24. $\begin{array}{r} 996 \\ - 89 \\ \hline 907 \end{array}$ |
| 25. $\begin{array}{r} 778 \\ - 35 \\ \hline 743 \end{array}$ | 26. $\begin{array}{r} 476 \\ - 208 \\ \hline 268 \end{array}$ | 27. $\begin{array}{r} 73 \\ - 17 \\ \hline 56 \end{array}$ | 28. $\begin{array}{r} 93 \\ - 66 \\ \hline 27 \end{array}$ |
| 29. $\begin{array}{r} 194 \\ - 45 \\ \hline 149 \end{array}$ | 30. $\begin{array}{r} 769 \\ - 452 \\ \hline 317 \end{array}$ | 31. $\begin{array}{r} 54 \\ - 7 \\ \hline 47 \end{array}$ | 32. $\begin{array}{r} 95 \\ - 32 \\ \hline 63 \end{array}$ |
| 33. $\begin{array}{r} 82 \\ - 54 \\ \hline 28 \end{array}$ | 34. $\begin{array}{r} 387 \\ - 285 \\ \hline 102 \end{array}$ | 35. $\begin{array}{r} 398 \\ - 54 \\ \hline 344 \end{array}$ | 36. $\begin{array}{r} 984 \\ - 176 \\ \hline 808 \end{array}$ |

Start with a two-digit number.

like this

25

Reverse the order of the digits.

like this

52

Subtract the lesser number from the greater.

$\begin{array}{r} 52 \\ - 25 \\ \hline 27 \end{array}$

What is the sum of the digits in your result? **9**

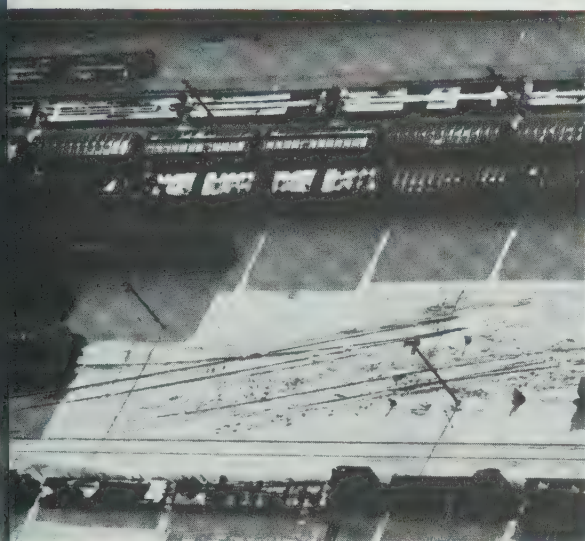
Try this five times. Start with a different two-digit number each time.

try this

85

RELATED ACTIVITIES

- If any children are having difficulty with an aspect of subtraction, assign appropriate activities suggested on preceding pages.
- The calendar activity on page T 59 could be adapted for subtraction.
- You could encourage the children to create a word problem for one of the exercises on page 85. The photograph could provide the topic for the problem.



TRY THIS: If you start with a number having the same digits, for example twenty-two, the result is zero. If you start with a number having different digits, the result is nine. (This includes cases with a difference of nine.)

LESSON OUTCOME

Subtract with regrouping hundreds as tens, minuends to 999

Materials

models for 9 hundreds, 18 tens, and 9 ones for each child

Prerequisite Skills

Complete basic subtraction facts

Checking Prerequisite Skills

Subtract.

1.

8

− 0

8
2.

11

− 9

2
3.

7

− 5

2
4.

12

− 3

9
5.

14

− 7

7
6.

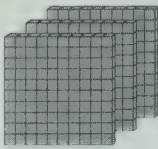
17

− 9

8

Subtraction, Regrouping Hundreds to Tens

Subtract 122 from 316.



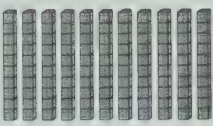
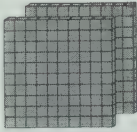
316

− 122

4

Show 316 − 122 in vertical form.

Subtract the ones.



2

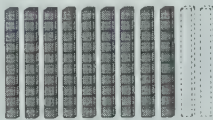
11

316

− 122

4

Cannot subtract 2 tens from 1 ten. Regroup 3 hundreds, 1 ten as 2 hundreds, 11 tens.



2

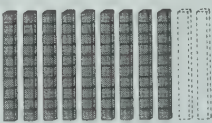
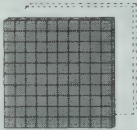
11

316

− 122

94

Subtract the tens.



2

11

316

− 122

194

Subtract the hundreds.

316 − 122 = 194

LESSON ACTIVITY

Before Using the Pages

- Use models for hundreds, tens, and ones. Have each child select models for 5 hundreds, 2 tens, and 7 ones. Ask what number these represent. Point out that there are 5 hundreds. Write the numeral on a place-value chart as you say that 5 hundreds 2 tens 7 ones is a name for five hundred twenty-seven. Ask the children to find a way of representing this number using only 4 hundreds. Lead them to suggest that 1 hundred can be regrouped as 10 tens. Have the children regroup the models by replacing one model for hundreds with models for 10 tens. Record the regrouping on the chart as shown and explain that 4 hundreds 12 tens 7 ones is another name for five hundred twenty-seven.

hundreds	tens	ones
4	12	
4	12	7

Use a similar procedure with 320 and then 604.

Using the Pages

- Have the children examine how the illustrations of models, the numbers on the numerals, and the instructions are coordinated for each step of the worked example. Point out that the ten is not regrouped as 10 ones because the ones can be subtracted without regrouping. Ask the children how tens can be subtracted. Develop that since 2 tens cannot be subtracted from 1 ten, 1 hundred of the 3 hundreds must be regrouped as 10 tens. Emphasize that 1 hundred is regrouped as 10 tens only when it is necessary for subtracting the tens. Explain that the regrouped number is the number used for subtracting. Ask why the tens are subtracted before the hundreds. Develop that before subtracting the hundreds, it is necessary to determine whether 1 hundred must be regrouped as 10 tens.

Working Together

Follow the steps.

1. Subtract ones.

Regroup 4 hundreds, 5 tens
as 3 hundreds, 15 tens.

Subtract 9 tens from 15 tens.

Subtract 2 hundreds
from 3 hundreds.

$$\begin{array}{r} 3 \text{ } 15 \\ 488 \\ - 293 \\ \hline 195 \end{array}$$

2. Subtract ones.

Regroup to show
one less hundred
and 10 more tens.

Subtract tens.

Subtract hundreds.

$$\begin{array}{r} 5 \text{ } 10 \\ 605 \\ - 165 \\ \hline 440 \end{array}$$

Subtract.

$$\begin{array}{r} 3. \quad 485 \\ - 193 \\ \hline 292 \end{array}$$

$$\begin{array}{r} 4. \quad 712 \\ - 60 \\ \hline 652 \end{array}$$

$$\begin{array}{r} 5. \quad 605 \\ - 535 \\ \hline 70 \end{array}$$

Exercises

Do three exercises on each banner. Write the result for the fourth one by using the pattern.

$$\begin{array}{r} 1. \quad 837 \\ - 694 \\ \hline 143 \end{array}$$

$$\begin{array}{r} 2. \quad 219 \\ - 75 \\ \hline 144 \end{array}$$

$$\begin{array}{r} 3. \quad 426 \\ - 281 \\ \hline 145 \end{array}$$

$$\begin{array}{r} 4. \quad 609 \\ - 463 \\ \hline 146 \end{array}$$

$$\begin{array}{r} 5. \quad 858 \\ - 572 \\ \hline 286 \end{array}$$

$$\begin{array}{r} 6. \quad 726 \\ - 340 \\ \hline 386 \end{array}$$

$$\begin{array}{r} 7. \quad 569 \\ - 83 \\ \hline 486 \end{array}$$

$$\begin{array}{r} 8. \quad 707 \\ - 121 \\ \hline 586 \end{array}$$

$$\begin{array}{r} 9. \quad 869 \\ - 495 \\ \hline 374 \end{array}$$

$$\begin{array}{r} 10. \quad 445 \\ - 82 \\ \hline 363 \end{array}$$

$$\begin{array}{r} 11. \quad 527 \\ - 153 \\ \hline 374 \end{array}$$

$$\begin{array}{r} 12. \quad 939 \\ - 576 \\ \hline 363 \end{array}$$

*13. Make up a fifth exercise to fit the pattern for each banner.

Answers will vary.

87

RELATED ACTIVITIES

- Have the children adapt the first activity described on page T 89 so that it can be used for subtraction with regrouping hundreds as tens.
- Children could be asked to find and correct the mistakes on a work sheet with the following completed subtraction exercises.

Subtract.

$$\begin{array}{r} 1. \quad 543 \\ - 292 \\ \hline \end{array}$$

$$\begin{array}{r} 2. \quad 457 \\ - 291 \\ \hline \end{array}$$

$$\begin{array}{r} 3. \quad 786 \\ - 295 \\ \hline \end{array}$$

$$\begin{array}{r} 351 \\ (251) \\ 639 \\ - 354 \\ \hline \end{array}$$

$$\begin{array}{r} 156 \\ (166) \\ 728 \\ - 273 \\ \hline \end{array}$$

$$\begin{array}{r} 492 \\ (491) \\ 463 \\ - 281 \\ \hline \end{array}$$

$$\begin{array}{r} 385 \\ (285) \\ 846 \\ - 273 \\ \hline \end{array}$$

$$\begin{array}{r} 555 \\ (455) \\ 538 \\ - 275 \\ \hline \end{array}$$

$$\begin{array}{r} 181 \\ (182) \\ 284 \\ - 191 \\ \hline \end{array}$$

$$\begin{array}{r} 663 \\ (573) \end{array}$$

$$\begin{array}{r} 373 \\ (263) \end{array}$$

$$\begin{array}{r} 13 \\ (93) \end{array}$$

Assessment

Subtract.

$$\begin{array}{r} 1. \quad 348 \\ - 162 \\ \hline 186 \end{array}$$

$$\begin{array}{r} 2. \quad 146 \\ - 66 \\ \hline 80 \end{array}$$

$$\begin{array}{r} 3. \quad 250 \\ - 180 \\ \hline 70 \end{array}$$

$$\begin{array}{r} 4. \quad 507 \\ - 457 \\ \hline 50 \end{array}$$

ask the children to express the number sentence at the bottom of page 86 in words. Refer to the statements at the bottom of pages 80 and 82. Lead the children to suggest that these are different ways of expressing subtraction.

Working Together: Discuss the reasons for the steps given for Ex. 1 and 2. Have the children express the steps orally for Ex. 3-5. Ex. 5 provides an opportunity to discuss when zero is written in the difference, for example 70, and when it is not, for example 07. Give more exercises and tell the children to think about the steps as they subtract.

Exercises: Make sure that the children understand the instructions, especially how to complete the fourth exercise on each banner. Have the children subtract for the fourth exercise on each banner to check whether they followed the pattern. Encourage the children to attempt Ex. 13 and make up a fifth exercise for each banner. Some children may enjoy the challenge of creating a sixth or a seventh exercise for each banner. Provide an opportunity for the children to compare their answers for Ex. 13.

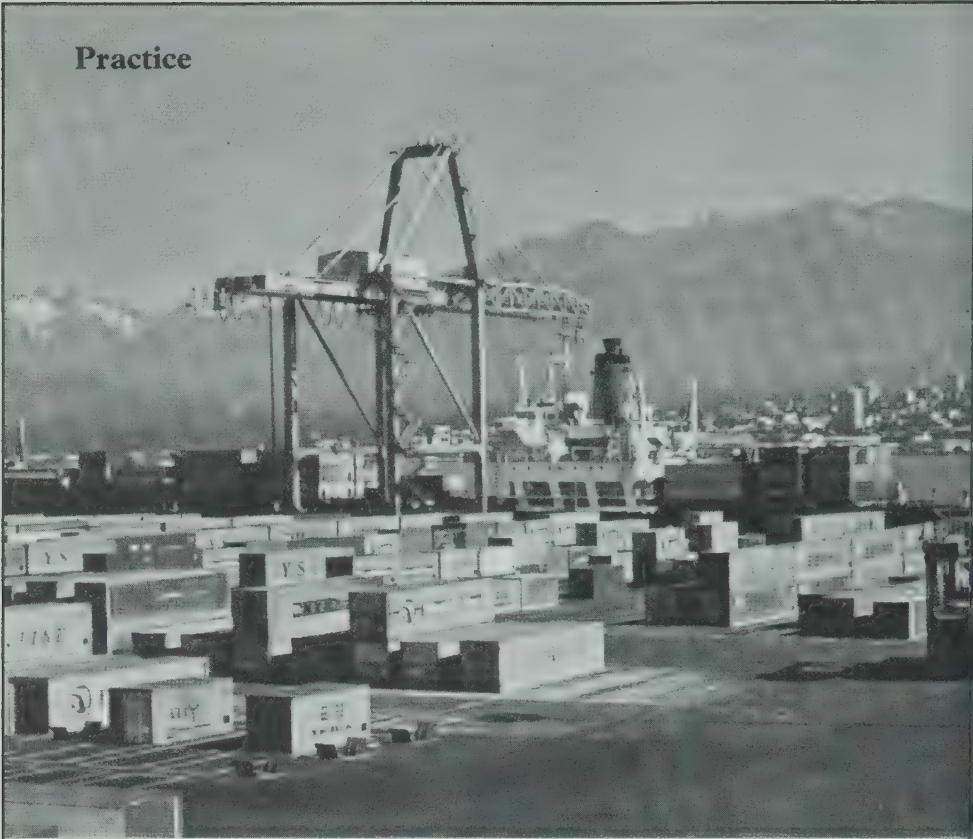
OBJECTIVE

Demonstrate competence in subtracting without regrouping and with one regrouping

Materials

a display map of Canada

Practice



Containers are used to ship cargo on land and sea.

Subtract as shown on each container. Match each result to a number in this table. Then name the place to where the container will be shipped.

Example:

1.
$$\begin{array}{r} 658 \\ - 338 \\ \hline 320 \end{array}$$

Thunder Bay

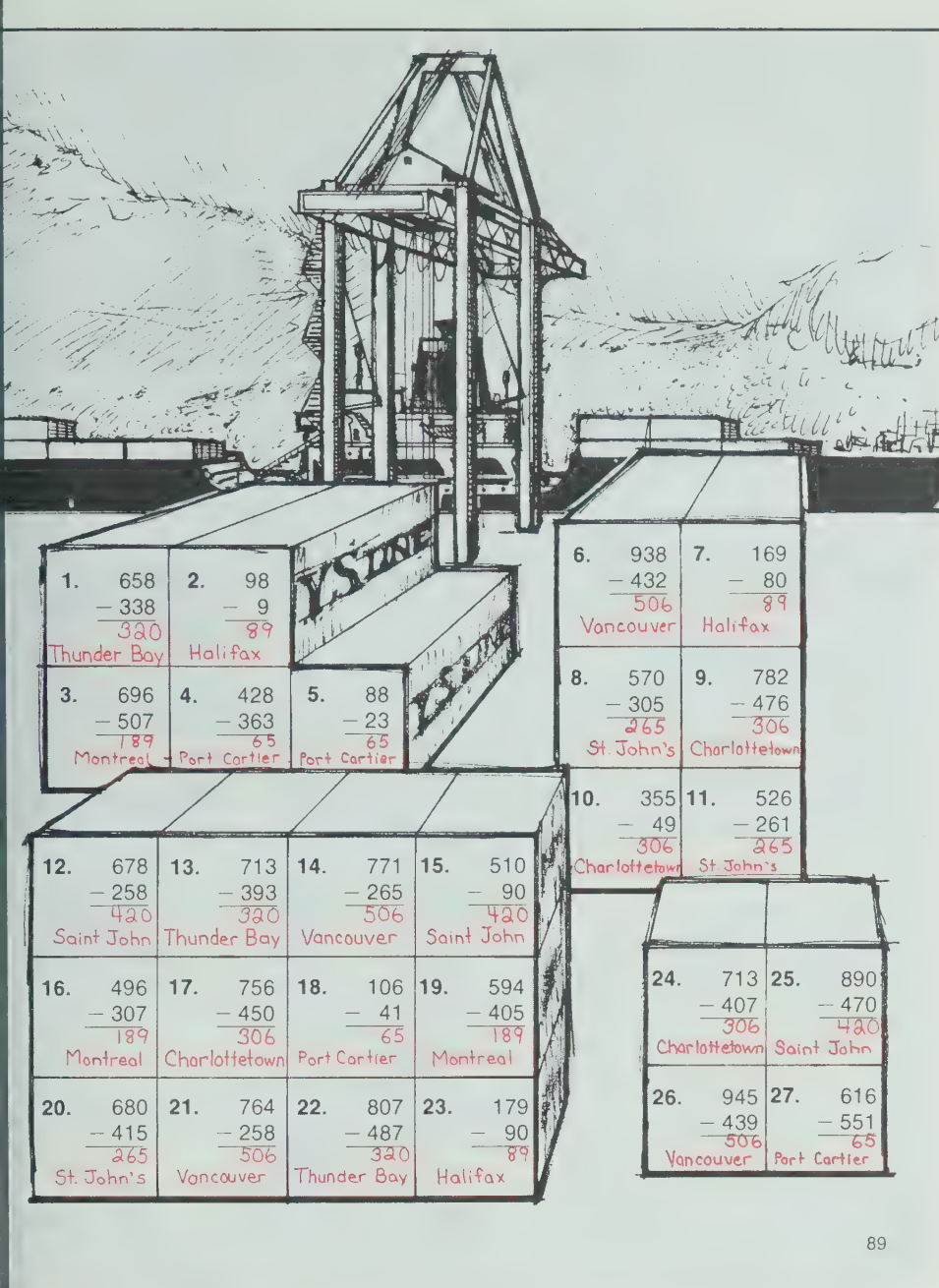
Difference	Ship to
265	St. John's
306	Charlottetown
89	Halifax
420	Saint John
65	Port Cartier
189	Montreal
320	Thunder Bay
506	Vancouver

LESSON ACTIVITY

Using the Pages

- Use the pictures on pages 88 and 89 to motivate a discussion about shipping. Children may enjoy guessing the contents of the containers and how they are shipped.
- Help the children locate their city, town, or the nearest populated area on the map of Canada. Then point out the cities named in the chart.
- Read the worked example with the children. Have them explain how they know the container will be shipped to Thunder Bay. Then ask questions such as, "If the difference of the two numbers shown on a container is 420, where will it be shipped?"
- Use these exercises to determine whether difficulties are due to the inability to recall subtraction facts or to a lack of understanding of regrouping. Reteach if necessary.

- After the children have completed the exercises, ask them to point out some exercises that require regrouping. Then have them explain the reason for each regrouping; for example, in Ex. 8, 5 ones cannot be subtracted from 0 ones, so 7 tens must be regrouped as 6 tens 10 ones.



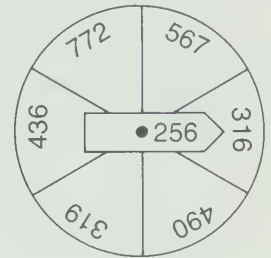
RELATED ACTIVITIES

• You could prepare a work sheet instructing the children to find the missing digits for subtraction exercises similar to the following.

$$\begin{array}{r} 26\square \\ - 19 \\ \hline \square 45 \end{array}$$

The number and the location of missing digits can be varied according to the ability of the children. Children could prepare subtraction exercises with missing digits for others to find. (The teacher should check the exercises before they are used, to ensure that they can be solved and with only one correct solution.)

• The spinner shown below could be used to provide subtraction exercises by spinning the arrow. The number on the arrow would be subtracted from the number on the dial.



• Children may be interested in comparing the number of containers being shipped to each port named in the chart. The children could list the ports and then mark a tally beside the name of a port for each container that is shipped there.

LESSON OUTCOME

Subtract with two regroupings, minuends to 999

Materials

models for 9 hundreds, 18 tens, and 18 ones for each child

Vocabulary

graph

Prerequisite Skills

Subtract with one regrouping, minuends to 999; align a minuend and a subtrahend in vertical form

Checking Prerequisite Skills

Subtract.

1.

258

- 49

209

2.

496

- 217

279

3.

534

- 280

254

Line up the hundreds, tens, and ones in vertical form.

4.

625

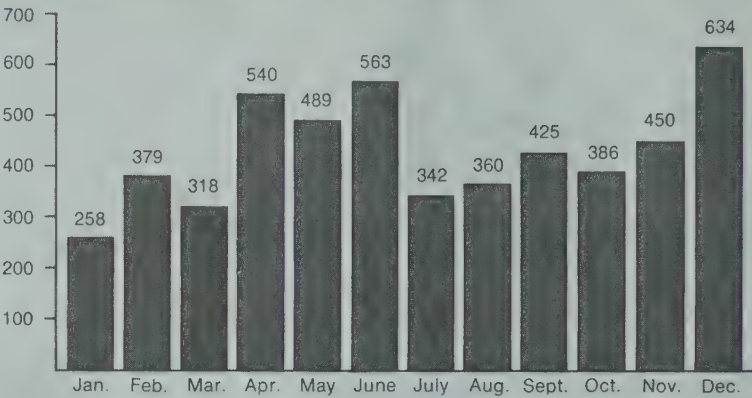
- 475

5.

130

- 19

Subtraction, Two Regroupings



The graph shows the number of deliveries each month. How many more were made in the busiest month than in the slowest month?

634 deliveries in December.
258 deliveries in January.
To find how many more, subtract

Cannot subtract
8 ones from 4 ones.
Regroup
3 tens, 4 ones as
2 tens, 14 ones.

634

- 258

634

- 258

6

Cannot subtract
5 tens from 2 tens.
Regroup
6 hundreds, 2 tens as
5 hundreds, 12 tens.

634

- 258

6

634

- 258

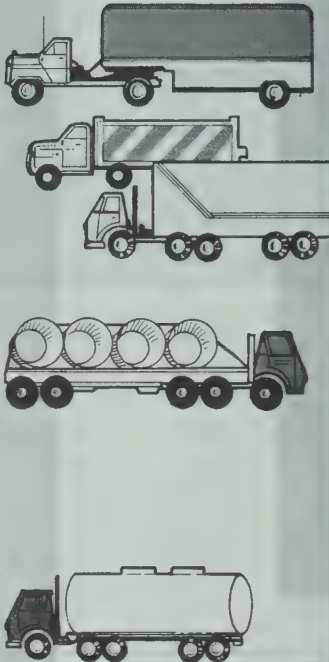
76

634

- 258

376

376 more deliveries were made in the busiest month than in the slowest month.



LESSON ACTIVITY

Before Using the Pages

- Have the children select models for 942. Ask in turn for the number of ones, tens, and hundreds, and show each number on a place-value chart. Write 177 on the place-value chart as shown.

Ask how the ones can be subtracted. Lead the children to suggest regrouping 1 ten as 10 ones. Have the children regroup the models by replacing one model for tens with models for 10 ones. Record the regrouping on the place-value chart as shown, and explain that 9 hundreds 3 tens 12 ones is another name for nine hundred forty-two. Then have the children remove models to show subtracting the ones. Ask for and record the difference in the ones' place.

Ask how the tens can be subtracted. Lead the children to suggest regrouping 1 hundred as 10 tens. Have the children regroup the models by replacing one model for hundreds with models for 10 tens. Record the regrouping on the

place-value chart as shown, and explain that 8 hundreds tens 12 ones is another name for nine hundred forty-two. Then have the children remove models to show subtracting the tens. Ask for and record the difference in the tens place.

Have the children remove models to show subtracting hundreds. Ask for and record the difference in hundreds' place. Finally ask for and record the number represented by 7 hundreds 6 tens 5 ones.

hundreds	tens	ones
	13	
8	8	12
8	4	2
- 1	7	7
7	6	5

765

Repeat this procedure with other examples that require regrouping both 1 ten as 10 ones and 1 hundred as 10 tens.

Working Together

Regroup to show 1 less hundred and 10 more tens. Then complete each exercise.

$$\begin{array}{r} 5\cancel{1}^{13} \\ 828 \\ - 365 \\ \hline 258 \end{array}$$

$$\begin{array}{r} 2\cancel{1}^{14} \\ 334 \\ - 67 \\ \hline 267 \end{array}$$

Subtract.

$$\begin{array}{r} 3. \quad 433 \\ - 177 \\ \hline 256 \end{array}$$

$$\begin{array}{r} 4. \quad 320 \\ - 89 \\ \hline 231 \end{array}$$

$$\begin{array}{r} 5. \quad 546 \\ - 248 \\ \hline 298 \end{array}$$

$$\begin{array}{r} 6. \quad 247 \\ - 179 \\ \hline 68 \end{array}$$

Exercises

Which month had more deliveries?

Subtract to find how many more.

1. May or June 74 2. March or April 222
3. December or June 71 4. January or February 121
5. November or January 192 *6. December, or January
and February together 3

Subtract.

$$7. \quad 326 - 77 \quad 249$$

$$8. \quad 912 - 455 \quad 457$$

$$9. \quad 93 - 47 \quad 46$$

$$10. \quad 214 - 56 \quad 158$$

$$11. \quad 536 - 284 \quad 252$$

$$12. \quad 750 - 371 \quad 379$$

$$\begin{array}{r} 13. \quad 427 \\ - 28 \\ \hline 399 \end{array}$$

$$\begin{array}{r} 14. \quad 877 \\ - 532 \\ \hline 345 \end{array}$$

$$\begin{array}{r} 15. \quad 692 \\ - 394 \\ \hline 298 \end{array}$$

$$\begin{array}{r} 16. \quad 385 \\ - 257 \\ \hline 128 \end{array}$$

$$\begin{array}{r} 17. \quad 342 \\ - 148 \\ \hline 194 \end{array}$$

$$\begin{array}{r} 18. \quad 509 \\ - 362 \\ \hline 147 \end{array}$$

$$\begin{array}{r} 19. \quad 125 \\ - 37 \\ \hline 88 \end{array}$$

$$\begin{array}{r} 20. \quad 615 \\ - 188 \\ \hline 427 \end{array}$$

$$\begin{array}{r} 21. \quad 910 \\ - 334 \\ \hline 576 \end{array}$$

$$\begin{array}{r} 22. \quad 534 \\ - 38 \\ \hline 496 \end{array}$$

$$\begin{array}{r} 23. \quad 473 \\ - 136 \\ \hline 337 \end{array}$$

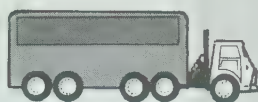
$$\begin{array}{r} 24. \quad 625 \\ - 49 \\ \hline 576 \end{array}$$

$$\begin{array}{r} 25. \quad 751 \\ - 196 \\ \hline 555 \end{array}$$

$$\begin{array}{r} 26. \quad 482 \\ - 199 \\ \hline 283 \end{array}$$

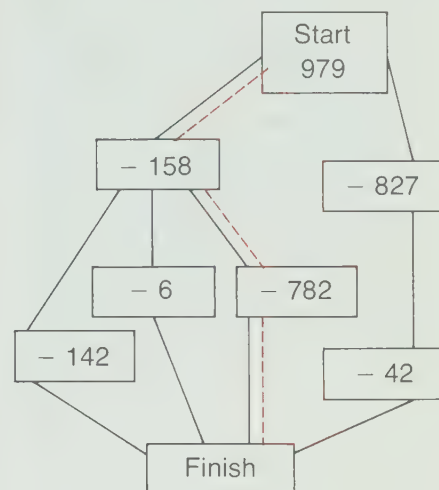
$$\begin{array}{r} 27. \quad 272 \\ - 86 \\ \hline 186 \end{array}$$

$$\begin{array}{r} 28. \quad 650 \\ - 257 \\ \hline 393 \end{array}$$



RELATED ACTIVITIES

- Have children adapt the first activity described on page T 89 for subtracting with two regroupings.
- Work sheets with paths similar to the following provide practice. The difficulty of the path can be varied according to the children's ability. Find the path for the answer 39.



Some children may find it easier to adapt the above activity by selecting a path and then completing the exercises in that path.

Using the Pages

Use the illustrations of trucks to motivate a discussion about the children's experiences with trucks. Have the children tell about deliveries by trucks and relate the delivery trucks to the illustrations on the page.

Have the children compare the height of each bar with the numerals on the left of the graph. Ask the children to explain the connection between the numeral at the top of each bar and the numerals at the left of the graph. Ask the following questions.

'How many deliveries were made in October?'

'In what month were the most deliveries made?'

Discuss each step of the worked example, relating the numerals in red and the explanations. Have the children express each regrouping in their own words.

Working Together: For Ex. 1 and 2, have children explain regrouping 1 ten as 10 ones and then regrouping 1 hundred as 10 tens.

Ask why the ones are subtracted first, then the tens, and then the hundreds. Lead the children to suggest that it is necessary to determine whether 1 ten must be regrouped as 10 ones for subtracting the ones and whether 1 hundred must be regrouped as 10 tens for subtracting the tens.

Exercises: Ensure that the children understand the instructions for Ex. 1-6. Some children may need help in realizing that Ex. 6 requires addition and subtraction. Remind the children to write Ex. 7-12 in vertical form.

Assessment

Subtract.

$$\begin{array}{r} 1. \quad 734 \\ - 256 \\ \hline 478 \end{array}$$

$$\begin{array}{r} 2. \quad 450 \\ - 167 \\ \hline 283 \end{array}$$

$$\begin{array}{r} 3. \quad 382 \\ - 85 \\ \hline 297 \end{array}$$

$$4. \quad 763 - 99 \quad 664$$

OBJECTIVE

Demonstrate competence in subtracting with and without regrouping, minuends to 999; solve related word problems

Practice

Subtract.

1. $959 - 612$ 347

2. $70 - 12$ 58

3. $336 - 74$ 262

4. $872 - 556$ 316

5. $564 - 173$ 391

6. $782 - 645$ 137
7. $\begin{array}{r} 67 \\ - 1 \\ \hline 66 \end{array}$

8. $\begin{array}{r} 96 \\ - 52 \\ \hline 44 \end{array}$

9. $\begin{array}{r} 358 \\ - 50 \\ \hline 308 \end{array}$

10. $\begin{array}{r} 978 \\ - 152 \\ \hline 826 \end{array}$

11. $\begin{array}{r} 43 \\ - 28 \\ \hline 15 \end{array}$

12. $\begin{array}{r} 791 \\ - 35 \\ \hline 756 \end{array}$

13. $\begin{array}{r} 23 \\ - 9 \\ \hline 14 \end{array}$

14. $\begin{array}{r} 873 \\ - 664 \\ \hline 209 \end{array}$

15. $\begin{array}{r} 480 \\ - 36 \\ \hline 444 \end{array}$

16. $\begin{array}{r} 977 \\ - 338 \\ \hline 639 \end{array}$

17. $\begin{array}{r} 519 \\ - 24 \\ \hline 495 \end{array}$

18. $\begin{array}{r} 509 \\ - 457 \\ \hline 52 \end{array}$

19. $\begin{array}{r} 605 \\ - 394 \\ \hline 211 \end{array}$

20. $\begin{array}{r} 629 \\ - 88 \\ \hline 541 \end{array}$

21. $\begin{array}{r} 327 \\ - 247 \\ \hline 80 \end{array}$

22. $\begin{array}{r} 966 \\ - 491 \\ \hline 475 \end{array}$

23. $\begin{array}{r} 431 \\ - 73 \\ \hline 358 \end{array}$

24. $\begin{array}{r} 914 \\ - 137 \\ \hline 777 \end{array}$

25. $\begin{array}{r} 631 \\ - 296 \\ \hline 335 \end{array}$

26. $\begin{array}{r} 441 \\ - 164 \\ \hline 277 \end{array}$

27. $\begin{array}{r} 351 \\ - 68 \\ \hline 283 \end{array}$

28. $\begin{array}{r} 571 \\ - 289 \\ \hline 282 \end{array}$

29. $\begin{array}{r} 968 \\ - 769 \\ \hline 199 \end{array}$

30. $\begin{array}{r} 922 \\ - 473 \\ \hline 449 \end{array}$

Solve.

31. 250 cars in the lot. 184 driven away. How many cars are left? 66

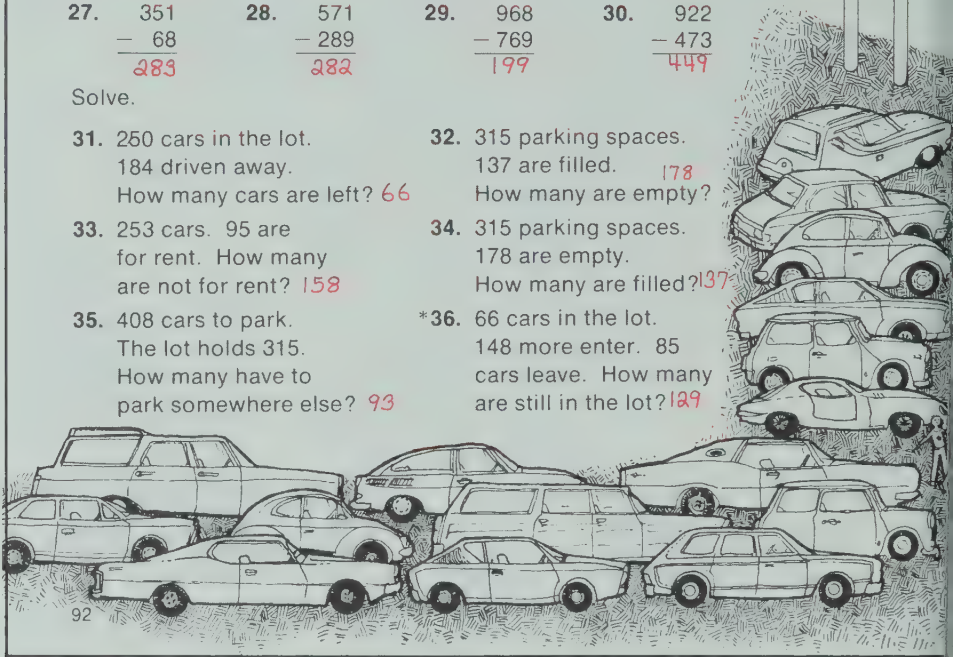
32. 315 parking spaces. 137 are filled. 178 How many are empty?

33. 253 cars. 95 are for rent. How many are not for rent? 158

34. 315 parking spaces. 178 are empty. How many are filled? 137

35. 408 cars to park. The lot holds 315. How many have to park somewhere else? 93

*36. 66 cars in the lot. 148 more enter. 85 cars leave. How many are still in the lot? 129



LESSON ACTIVITY

Using the Pages

- Use the pictures to encourage a discussion about renting cars. Children may have been in a rented car or they may have seen cars being rented on television.
- Have children create one or two subtraction word problems about renting cars for other children to solve.
- Tell the children to write Ex. 1-6 in vertical form. For Ex. 1-30, remind the children to determine whether regrouping is necessary before they regroup. Encourage accuracy and speed. For Ex. 31-36, remind the children to show the subtraction in vertical form and write the answer in a sentence.
- After the children complete the exercises, have them point out some exercises that require regrouping and explain the reason for regrouping.

Problem Solving: To help the children interpret the table questions similar to the following.

- "How many large cars are rented by the day?"
- "How many large cars are rented by the week?"
- "How many large cars are rented?"

Have children who are able to understand the involved in answering the problems work independently. Remind them to show the addition and subtraction in vertical form and to answer each question in a sentence. Have them discuss their answers.

Help those children who are unable to follow the instructions independently.

What would the calculator show for the difference?

37.

00000000

00000000

00000000

375

38.

00000000

00000000

00000000

95

Reports help companies keep track of business.

This table is from a weekly report made for a car-rental company. Use the table to help you answer the questions.

	Large cars	Small cars
Daily rentals	277	325
Weekly rentals	82	109

1. Were there more rentals of large cars or of (small cars?) 75
How many more?
2. Were there more cars rented (by the day) or by the week? 411
How many more?
3. Of all the cars rented, 716 have been returned.
How many are still out? 77



PROBLEM SOLVING

RELATED ACTIVITIES

- Children could use the three dice described on page T67 and adapt the game for subtraction.
- Have children list several subtraction exercises. They could dramatize a situation for each or use them as themes for creating word problems, with one or two steps. Have children solve word problems created by other children.
- To practice subtraction skills, three teams of children may play a game in which a three-digit number (without zeros) is written on the board. One child draws a numeral card (with a two-digit number) from a jar and tells the other children to subtract the number drawn from the number on the board. The first child to find the difference scores a point for her/his team.

LESSON OUTCOME

Subtract with regrouping with zero
tens in the minuend, minuends to 999;
solve related word problems

Prerequisite Skills

Subtract with regrouping, minuends to 999

Checking Prerequisite Skills

Subtract.

1.

426

− 307

119
2.

540

− 450

90
3.

427

− 167

260
4.

333

− 144

189

Subtraction, Regrouping with Zero



There were 506 dump trucks. 287 were shipped
to fill orders. How many dump trucks are left?

Subtract 506
 − 287

4 9 16
~~506~~
− 287

Think of 506 as 50 tens and 6 ones.
Regroup 50 tens, 6 ones as
49 tens, 16 ones.

4 9 16
~~506~~
− 287

219

Subtract ones.
Subtract tens.
Subtract hundreds.

There are 219 dump trucks left.

94

LESSON ACTIVITY

Before Using the Pages

- Write 200 on a place-value chart. Ask for the number of hundreds, tens, and ones.

hundreds	tens	ones
2	0	0

Ask for and record the number of hundreds, tens, and ones that result from regrouping all the hundreds as tens.

hundreds	tens	ones
0	20	0

Ask for and record the number of hundreds, tens, and ones that result from regrouping 1 of the 20 tens as 10 ones.

hundreds	tens	ones
0	19	10

Emphasize that these are different ways of naming the same number.

- Present the following as a shorter way for this regrouping without using the place-value chart. Have the children think of 200 as 20 tens and then as 19 tens 10 ones. Record regrouping as shown.

19 10
~~20~~ 0

Try the shorter method with 100 and with 402.

Using the Pages

- The pictures provide an opportunity to encourage the children to discuss what they know about dump trucks and bulldozers. Use the discussion to introduce the problem. Ask why subtraction is used to solve the problem. Present the subtraction exercise as a reason for learning to rename numerals with zero tens. Relate the numerical explanations for each step of the worked example. Emphasize that regrouping is necessary because more ones are needed in order to subtract. Ask why it is important to start with the ones, proceed to the tens, and then to the hundreds when subtracting.

Working Together

Regroup 402 as ^{3 9 12}402 and subtract.

1. 402
- 167

235

2. 402
- 38

364

3. 402
- 346

56

Regroup 600 as ^{5 9 10}600 and subtract.

4. 600
- 246

354

5. 600
- 97

503

Subtract.

6. 904 - 326 578

7. 700 - 412 288

8. 303
- 245

58

Exercises

Solve.

1. There are 483 bulldozers. There are orders for 600 bulldozers. How many more bulldozers are needed? 117

2. There are 219 dump trucks and 404 end loaders. How many more end loaders than dump trucks are there? 185

Copy this puzzle on paper and complete.

	a	b		
	6	2	5	
c	5	0	9	d
e	7	2		6 8
	3		g	3 7 5
	h	4	6	7
i	3	3	8	j
k	3	6		5 8
	7		m	8 0 6
	n	6	7	0

- Across

a. 920 - 295

c. 971 - 462

e. 451 - 379

f. 132 - 64

g. 548 - 173

h. 896 - 429

i. 736 - 398

j. 506 - 499

k. 132 - 96

l. 712 - 654

m. 904 - 98

n. 847 - 177
- Down

a. 900 - 298

b. 66 - 37

c. 841 - 268

d. 256 - 71

f. 982 - 305

g. 407 - 39

h. 828 - 392

i. 900 - 563

j. 915 - 129

l. 736 - 236

m. 305 - 218

n. 523 - 517

RELATED ACTIVITIES

- A hidden “bingo” on the chart on page T53 could be found using the following subtraction exercises.

403
- 226

177

800
- 174

626

301
- 207

94

506
- 140

366

200
- 131

69

700
- 566

134

100
- 77

23

909
- 361

548

103
- 55

48

- The following activity provides practice in regrouping with zero and encourages children to compare and order numbers.

9	0	
-		

Prepare a numeral card for each number from 1 to 8 and work sheets with charts similar to the one shown. As you draw each of four cards in turn, read the number and have the children write it in any of the four squares above the double line. Then have the children subtract. The player (or players) with the smallest difference scores one point. The game could end after a certain number of charts are completed.

Working Together: Have the children follow the regrouping shown for Ex. 1-5. Ex. 6-8 provide practice in thinking of the hundreds as tens and regrouping hundreds as tens and ones. Have the children explain this regrouping for each exercise. Provide other examples.

Exercises: For Ex. 1 and 2, remind the children to show the subtraction in vertical form and to answer the question in a sentence. Provide a copy of page T360 for each child to cut a nine-by-five grid, and then color and label the appropriate squares to prepare a puzzle similar to the one on page 95. Review how to complete a puzzle and how to check the answers in the squares in which the answers overlap. Have the children write each subtraction in vertical form before subtracting.

Assessment

Subtract.

1. 308
- 9

299

2. 607
- 598

9

3. 400 - 239 161

4. 201 - 32 169

LESSON OUTCOME

Subtract amounts of money with regrouping, minuends to \$9.99

Materials

real or play money (dollars, dimes, and pennies)

Vocabulary

fare

Prerequisite Skills

Subtract with regrouping, minuends to 999

Checking Prerequisite Skills

Subtract.

1.
$$\begin{array}{r} 432 \\ - 392 \\ \hline 40 \end{array}$$
2.
$$\begin{array}{r} 500 \\ - 236 \\ \hline 264 \end{array}$$
3.
$$\begin{array}{r} 642 \\ - 13 \\ \hline 629 \end{array}$$
4.
$$\begin{array}{r} 786 \\ - 699 \\ \hline 87 \end{array}$$

Subtracting Amounts of Money

Peter's sister drives a taxi.
One ride cost \$3.75. The rider gave her a five-dollar bill. How much did Peter's sister give back?

Subtract \$3.75 from \$5.00.

$$\begin{array}{r} 4910 \\ \$5.00 \\ - 3.75 \\ \hline \$1.25 \end{array}$$

Peter's sister gave back \$1.25.

Working Together

Line up the dollars and cents in vertical form.

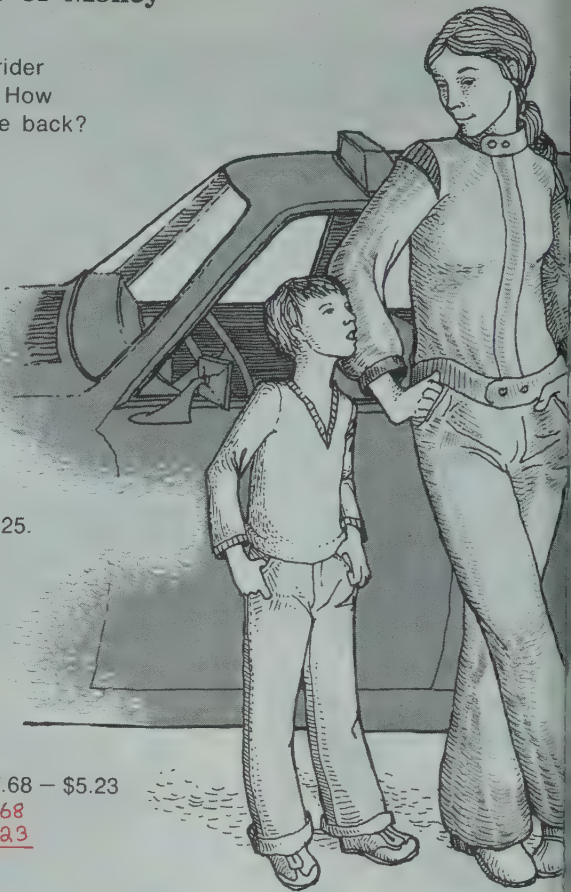
1.
$$\begin{array}{r} \$4.09 \\ - 2.53 \\ \hline \end{array}$$
2.
$$\begin{array}{r} \$7.68 \\ - 5.23 \\ \hline \end{array}$$
3.
$$\begin{array}{r} \$6.07 \\ - 2.58 \\ \hline \end{array}$$
4.
$$\begin{array}{r} \$5.23 \\ - 4.35 \\ \hline \end{array}$$

Exercises

Subtract.

1.
$$\begin{array}{r} \$5.68 \\ - 3.25 \\ \hline \end{array}$$
2.
$$\begin{array}{r} \$7.15 \\ - 4.30 \\ \hline \end{array}$$
3.
$$\begin{array}{r} \$5.05 \\ - 2.98 \\ \hline \end{array}$$
4.
$$\begin{array}{r} \$7.23 \\ - 4.58 \\ \hline \end{array}$$
5.
$$\begin{array}{r} \$8.50 \\ - 3.75 \\ \hline \end{array}$$
6.
$$\begin{array}{r} \$6.23 \\ - 4.99 \\ \hline \end{array}$$
7.
$$\begin{array}{r} \$3.08 \\ - 1.79 \\ \hline \end{array}$$

96



LESSON ACTIVITY

Before Using the Pages

- Display amounts of money to \$9.99 and have children complete the chart shown.

Dollars	Dimes	Pennies	Amount

- Reverse this procedure and write the amount on the chart. Have children select the amounts of money named and complete the other columns of the chart.
- Use the information on the chart to show the regrouping of 1 dime as 10 pennies. Emphasize that the amount of money is the same.

Dollars	Dimes	Pennies	Amount
2	$\frac{7}{8}$	$\frac{15}{5}$	\$2.85

Have the children regroup other amounts to show more dimes and/or 10 more pennies.

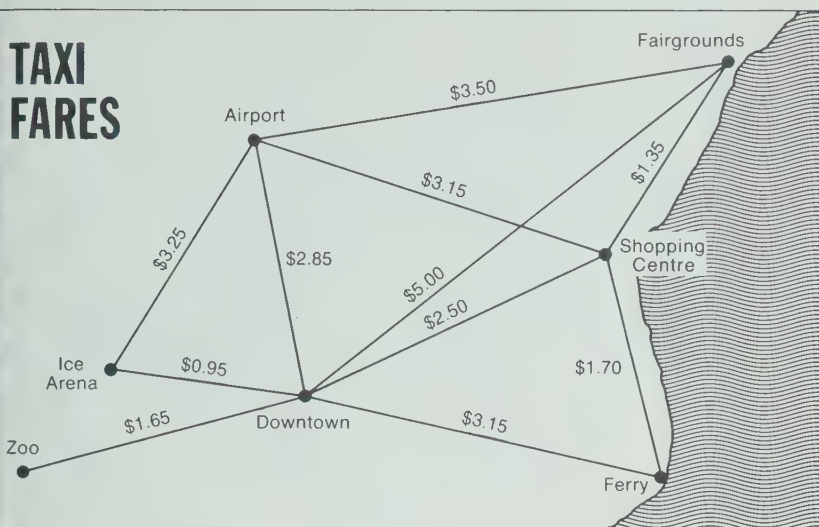
Have the children regroup \$4.00 to show 40 dimes, 39 dimes 10 pennies, and then 3 dollars 9 dimes pennies.

Using the Pages

- Use the illustration to encourage a discussion about riding taxi or seeing a taxi on the street. Have the children consider how to solve the problem. Discuss the subtraction as an exercise that is similar to those on the preceding pages.

eter's sister has this chart in her taxi.
se it to solve the problems.

TAXI FARES



1. From the airport, does it cost more to go downtown or to the shopping centre? How much more? \$0.30 or 30¢
2. For a trip from downtown to the zoo, how much does a rider get back from \$5.00? \$3.35
3. Does it cost more to go from the airport to the fairgrounds, or from the ferry to the fairgrounds? How much more? \$0.45 or 45¢
4. Which way from the ice arena to the fairgrounds costs the least? through downtown and then past the shopping centre
5. To go to the ferry, does it cost more from downtown or from the shopping centre? How much more? \$1.45
6. Does it cost more to go from the airport to the fairgrounds or from the zoo to downtown? How much more? \$1.85
7. Does it cost less to go from the airport to the ferry through downtown or past the shopping centre? How much less? \$1.15
8. One rider went from the ferry to downtown, and then to the shopping centre. How much did the rider get back from \$7.00? \$1.35

97

RELATED ACTIVITIES

- Children may enjoy creating and solving subtraction word problems about taxi fares on the map on page 97.
- Children could pretend to shop for the bicycle items on page 65. They could determine the change they would receive from \$8.00, or they could compare the prices of two items by finding the difference.
- A play store in the classroom would provide the opportunity for children to buy items with play money. The clerk would calculate the change, and the buyer would check it.
- Children in pairs can use play money to dramatize taxi situations. One child would pretend to be the driver and name the fare. The other child would pay the fare in an exact number of dollars, and the driver would calculate the change.
- Newspaper advertisements showing items for sale may be pasted on cards with problems about the advertisements. Some children may wish to create their own word problems about the advertisements.

Working Together: Emphasize lining up the numerals in vertical form for Ex. 1 and 2. Point out the position of the decimal point and the dollar sign. Ex. 1 and 3 review regrouping with zero tens.

Exercises: Remind the children to line up the dollars and cents in vertical form for Ex. 1-3. Point out the spelling of the word *fare*. To help the children understand the map, ask them to point out the water, the land, places on the map such as the airport, and a taxi route with a named cost such as \$1.65. Have them use their fingers to trace routes from one place to another. Then ask them to trace different routes between two places.

For Ex. 8-15 remind the children to show their work in vertical form and to answer the question in a sentence. Ex. 12-15 are starred because the solutions require more than one step. For Ex. 14, the children could suggest reasons, such as different traffic conditions, that result in the ride from downtown to the fairgrounds past the shopping center costing less than the direct route.

Assessment

Subtract.

$$\begin{array}{r} 1. \quad \$5.23 \\ - \quad 4.11 \\ \hline \$1.12 \end{array}$$

$$\begin{array}{r} 3. \quad \$7.03 - \$4.28 \\ \hline \$2.75 \end{array}$$

$$\begin{array}{r} 2. \quad \$6.73 \\ - \quad 2.99 \\ \hline \$3.74 \end{array}$$

$$\begin{array}{r} 4. \quad \$6.00 - \$2.01 \\ \hline \$3.99 \end{array}$$

OBJECTIVE

Solve problems involving two steps

Materials

objects to illustrate the problems

RELATED ACTIVITIES

- Children could create, illustrate, and solve two-step problems, or they could write the problem on the front of a card and the solution on the back. Newspaper and magazine advertisements described on page T 105 or the transportation theme of Unit 5 would provide topics for the problems. (The teacher should check the exercises before they are used to ensure that they can be solved and that the answers are correct.)
- Children could combine the problem-solving concepts on this page with those on page 46 by remembering or creating two-step problems that do not involve numbers. Examples of these would be problems arising from real-life situations.

Solving Problems in Two Steps

Solutions may vary.
Sometimes two steps are needed to solve a problem.

$$\begin{array}{r} 1. \quad 800 \\ -288 \\ \hline 512 \end{array} \quad \begin{array}{r} 512 \\ -345 \\ \hline 167 \end{array} \quad \begin{array}{r} 167 \\ +65 \\ \hline 202 \end{array} \quad \begin{array}{r} 202 \\ -108 \\ \hline 94 \end{array}$$

Example: A store had 208 ice cream bars.
It sold 132. The ice cream company delivered 288 more. Now how many ice cream bars are in the store?

Step 1:

$$\begin{array}{r} \text{started with} \dots\dots\dots 208 \\ \text{sold} \dots\dots\dots -132 \\ \hline \text{had left} \dots\dots\dots 76 \end{array}$$

Step 2:

$$\begin{array}{r} 76 \\ +288 \\ \hline 364 \end{array}$$

$$\begin{array}{r} 3. \quad 75 \\ -38 \\ \hline 37 \end{array} \quad \begin{array}{r} 37 \\ +55 \\ \hline 92 \end{array} \quad \begin{array}{r} 4. \quad 58 \\ +77 \\ \hline 135 \end{array} \quad \begin{array}{r} 136 \\ -135 \\ \hline 1 \end{array}$$

Solve. Show two steps for each problem.

- A truck had 800 boxes. It delivered 288 to the first store and 345 to the second store. How many boxes are left on the truck?
- 137 cars were in the parking lot. 65 more entered. 108 left. Now how many cars are in the lot?
- A train had 75 boxcars. 38 were taken off at the first stop. 55 were taken on. Now how many boxcars does the train have?
- 58 ships unloaded in June. 77 unloaded in July. 136 unloaded in August. How many more unloaded in August than in June and July together?
- Kevin had \$5.00. He spent \$2.89. He earned \$3.50 more. Now how much does Kevin have?
- Violet took \$5.00 to the shopping center. She spent \$1.47 in one store and \$2.75 in another. How much money does Violet have left?

PROBLEM SOLVING

$$\begin{array}{r} 5. \quad \$5.00 \\ -2.89 \\ \hline \$2.11 \end{array} \quad \begin{array}{r} \$2.11 \\ +3.50 \\ \hline \$5.61 \end{array} \quad \begin{array}{r} 6. \quad \$5.00 \\ -1.47 \\ \hline \$3.53 \end{array} \quad \begin{array}{r} \$3.53 \\ -2.75 \\ \hline \$0.78 \text{ or } 78\text{¢} \end{array}$$

LESSON ACTIVITY

Before Using the Page

- Have the children illustrate a two-step problem as you record each step on the board. Ask a child to place nine objects on a table. Ask another child to remove three of the objects. Then have another child place eight more objects on the table. Ask how many objects are now on the table. Discuss each step of the solution.

Using the Page

- Discuss each step in the solution of the worked example.
- Have as many children as are capable attempt the challenge of the problems. Provide an opportunity for them to discuss the solutions and compare different possible solutions.

For the children who have difficulty completing the problems independently, you could go through each step of Ex. 1-6 in a manner similar to the one in the worked example.

Checking Up

Subtract.

1. $\begin{array}{r} 76 \\ - 61 \\ \hline 15 \end{array}$
2. $278 - 35$ **243**
3. $\begin{array}{r} 696 \\ - 423 \\ \hline 273 \end{array}$
4. $484 - 132$ **352**
5. $74 - 55$ **19**
6. $\begin{array}{r} 44 \\ - 7 \\ \hline 37 \end{array}$
7. $280 - 24$ **256**
8. $\begin{array}{r} 492 \\ - 318 \\ \hline 174 \end{array}$
9. $\begin{array}{r} 329 \\ - 51 \\ \hline 278 \end{array}$
10. $\begin{array}{r} 616 \\ - 262 \\ \hline 354 \end{array}$
11. $\begin{array}{r} 407 \\ - 84 \\ \hline 323 \end{array}$
12. $\begin{array}{r} 669 \\ - 385 \\ \hline 284 \end{array}$
13. $\begin{array}{r} 932 \\ - 234 \\ \hline 698 \end{array}$
14. $\begin{array}{r} 813 \\ - 598 \\ \hline 215 \end{array}$
15. $\begin{array}{r} 536 \\ - 97 \\ \hline 439 \end{array}$
16. $\begin{array}{r} 630 \\ - 462 \\ \hline 168 \end{array}$
17. $\begin{array}{r} 705 \\ - 79 \\ \hline 626 \end{array}$
18. $\begin{array}{r} 400 \\ - 236 \\ \hline 164 \end{array}$
19. $\begin{array}{r} 404 \\ - 46 \\ \hline 358 \end{array}$
20. $\begin{array}{r} 600 \\ - 103 \\ \hline 497 \end{array}$
21. $\begin{array}{r} \$9.83 \\ - 6.16 \\ \hline \$3.67 \end{array}$
22. $\begin{array}{r} \$3.23 \\ - 1.71 \\ \hline \$1.52 \end{array}$
23. $\begin{array}{r} \$6.23 \\ - 0.84 \\ \hline \$5.39 \end{array}$
24. $\begin{array}{r} \$9.00 \\ - 4.87 \\ \hline \$4.13 \end{array}$

Solve.

25. 134 dump trucks.
179 delivery trucks.
How many more delivery trucks are there? **45**
26. 450 deliveries in November.
634 deliveries in December.
How many fewer deliveries were there in November? **184**
27. 206 buses.
32 need repairs.
How many buses do not need repairs? **174**
28. 174 buses running.
88 are filled with riders. How many are not filled? **86**
29. 208 riders got on the train at the first stop.
92 got on at the second stop. How many more got on at the first stop? **116**
30. 300 people on the train.
142 get off.
How many people are left on the train? **158**
31. A one-way ticket costs \$2.25.
How much does a rider get back from \$5.00? **\$2.75**
32. A return ticket costs \$3.37.
How much does a rider get back from \$5.02? **\$1.65**

99

OBJECTIVE

Demonstrate an understanding of the concepts and skills presented in this unit

RELATED ACTIVITIES

• To encourage children to think about the reasons for subtracting, divide the class into groups of four. Give a piece of paper and a pencil to a "recorder" in each group. Allow a specified amount of time, perhaps five minutes, for the members of each group to tell their recorder as many examples of subtraction situations in everyday life as possible. The recorder lists the situations. The group with the most examples of subtraction situations is the winner.

Skills	Exercises	Related Pages
Subtract, no regrouping	1-4	T 88-T 89
Subtract, regrouping tens as ones	5-8	T 90-T 91
Subtract, regrouping hundreds as tens	9-12	T 94-T 95
Subtract, two regroupings	13-16	T 98-T 99
Subtract, regrouping with zero tens	17-20	T 102-T 103
Subtract, amounts of money	21-24	T 104-T 105
Use subtraction word problems	25-32	

Comments

Use the chart showing the skills required for each exercise on this page to facilitate locating an area of difficulty. Usually children who answer correctly almost all the exercises for a skill have mastered that skill. Children should review a skill for which they answer only half the exercises correctly. If children answer less than half of the exercises correctly, that skill should be retaught.

Children often regroup without first determining whether regrouping is necessary. If this happens, have the children examine each exercise to decide whether regrouping is necessary and why it is necessary. Emphasize that regrouping is necessary only when the digits cannot be subtracted without regrouping.

Children frequently require more practice subtracting with zero in the tens' place of the minuend in order to master the skill and to understand the regrouping.

Children often subtract the top number from the second number in a column, especially if the second number is greater. If this occurs, have children complete subtraction exercises by using models to represent the minuend (top number) and then removing models to represent subtracting the subtrahend (second number). After a few examples, help them record each step as they complete it with models. Emphasize that the top number shows the number at the beginning and that the second number shows the number that is being subtracted.

Unit 6 Overview

Measurement

This unit continues the development of measurement concepts that were begun in earlier levels for length, capacity, mass, temperature, and time. Much of the unit deals with length. The need for standard units of length is demonstrated in the first lesson. Thereafter, attention is directed toward developing specific skills in selecting the appropriate unit, estimating length in that unit, and carrying out the measurement. The centimetre, decimetre, and metre are discussed. Children are expected to measure length using centimetre rulers, unmarked and marked metre sticks and tape measures, and to measure objects accurately to the nearest appropriate unit. Attention is given to the relationship among metres, decimetres, and centimetres, and children are asked to use different units to describe a given length. The concept of perimeter, which is essentially a linear concept, is introduced here and provides practice in measuring length.

Similar skills are dealt with in estimating and measuring capacity and mass in litres and kilograms, respectively. Referents are described for one, ten, and one hundred litres, and one, ten, and one hundred kilograms. Work with temperatures encourages children to associate different outdoor temperatures in degrees Celsius with familiar seasonal activities such as skating or swimming. The unit concludes with a lesson concerning times at one-minute marks.

Prerequisite Skills

- measure and estimate length, capacity, and mass using non-standard units
- associate outdoor activities with weather conditions that are hot, warm, cool, or freezing
- show times and write numerals and words for times at five-minute marks

Unit Outcomes

- demonstrate the need for standard units of measurement
- estimate and measure length in centimetres, decimetres, and metres
- compare lengths using metres, decimetres, and centimetres
- demonstrate an understanding of the relationships among centimetres, decimetres, and metres
- find the perimeter of a shape
- estimate and measure capacity in litres
- estimate and measure mass in kilograms
- read a thermometer and record the temperature in degrees Celsius
- show times and write numerals and words for times at one-minute marks
- determine whether an answer is reasonable

Background

The metric system first began in the late eighteenth century in France where a committee was established to review the measurement situation and to determine whether a rational system of measurement was possible. As a result, the units *metre*, *litre*, and *gram* were created. Since that time, attempts have been made to simplify and standardize measurement all over the world. The present version of the metric system was

established in 1960 to modernize metric practice. It has been called the *International System of Units*, or *SI* (from the French name, *Le Système International d'Unités*).

In the past, most measurement systems lacked ratio structure. They developed from parts of the body used as units such as the hand and the foot, and have often depended on local customs and adaptations. Thus, to convert from one unit to another involved such diverse factors as 2, 4, $5\frac{1}{2}$, 12, 1760. The metric system, however, is based on the simple and logical decimal system, and its advantages arise from this. Units are related by factors such as 10, 100, and 1000. Thus, conversion from one unit of length, capacity, or mass to another is a simple matter involving the position of the decimal point, making computation much easier. Furthermore, the main units for measuring length, capacity, and mass are themselves easily related.

The *metre* is the base unit of length. All other units of length are obtained by multiplying one metre by a power of ten. The prefix attached to the word *metre* indicates which power of ten is the multiplier. The *kilometre* (km), for instance, is a unit of length equal to one thousand metres. A unit one one-hundredth the length of a metre is the *centimetre* (cm).

It was stated earlier that an advantage of the metric system is that the main units for measuring length, capacity, and mass are easily related. Specifically, if a cube is made with each edge one-tenth of a metre in length (one decimetre or ten centimetres), the cube will have a volume of *one cubic decimetre* or one thousand cubic centimetres. This volume is also called a *litre* (L). Capacity is usually thought of in terms of liquid measure. Large milk cartons often have a base that measures one decimetre by one decimetre. Children can cut the carton at a height of one decimetre and thereby obtain a container whose capacity is one litre.

Mass refers to the quantity of matter in an object and may be measured by placing the object on one side of a balance scale and standard units of mass on the other. Weight is probably a more familiar term than mass, but the two are not the same. Weight is the measure of force required to lift or support an object and is measured by a spring balance. Thus, weight may vary since it is influenced by gravity. Mass cannot vary since the force of gravity is the same on both sides of the balance scale.

The *kilogram* (kg) is the base unit of mass. One kilogram is the mass of one litre of water.

The unit commonly used for measuring temperature is the *degree Celsius* (°C) after the Swedish astronomer Anders Celsius who originally proposed the scale for which water freezes at 0°C and boils at 100°C.

Units for measuring time are an exception to the rule that units must be related by powers of ten. Units such as the day (d), hour (h), minute (min), and second (s) were included in SI because their use was already accepted worldwide.

Before this time the children have likely had sufficient experience with non-standard units to acquire an understanding of what is entailed in measurement. To measure an object is to determine its size or amount by comparing some aspect of it to a selected unit and counting the number of times the unit is contained in the object. Thus, each measurement expresses two things: the *measure* which indicates "how many" and the *unit* which indicates the unit of measurement with which the object is compared. Activities involving non-standard units help children to realize that standard units are needed for effective communication to take place among people. Probably one of the

Mathematical needs of a society is a system of standard measurement.

As soon as children begin to develop measuring skills, they are faced with the concept of exactness. For example, few objects have an exact length of 2 cm. They are more likely to be rounded to the nearest centimetre or 20 mm to the nearest millimetre. It is necessary to define the accuracy required according to need and to the precision of the available measuring devices. In this unit, children are expected to measure objects to the nearest unit being used. For example, the length of a line segment 7.7 cm long is 8 cm to the nearest centimetre, because 7.7 is closer to 8 cm than it is to 7 cm. The word “about” is used to indicate that a measurement has been “rounded”. For example, the line segment is “about 8 cm long”.

Measuring Strategies

In first-year and second-year mathematics programs children learn measurement concepts largely through laboratory activities. This emphasis should be continued. It is important to ensure that all children have direct experiences in measuring and estimating.

Determine to what extent the children have had previous experiences with non-standard units of length, capacity, and mass. A measurement area or table may be set up in one part of the classroom before this unit is approached formally, and children may be given an opportunity to explore activities with non-standard units. In this way children can develop an understanding of the length, capacity, or mass of an object before they encounter standard units.

Commercial measuring devices and those that are teacher-made are useful in the classroom. Children can help to prepare a demonstration thermometer for work with temperature, and dial clock faces for work with time. A procedure was described earlier for preparing a one-litre container. It can be used to find other containers that hold about one litre, and also to mark levels on larger containers to show one litre, two litres, three litres, and so on. For length, centimetre squares can be pasted end to end along a cardboard strip to prepare a centimetre strip. If 10 centimetre squares are pasted end to end along a decimetre strip, the relation between the two units of length can be “discovered”. Similarly, 10 decimetre strips can be pasted end to end along an unmarked metre strip. Children who are given an opportunity to discover the metric relationships are more likely to remember them and recall them as needed.

When children have had considerable experience in measuring with a unit, they are ready to consider estimating with that unit. An estimate should be a carefully considered opinion. Children who make reasonable estimates with a unit have developed a feeling for the magnitude represented by that unit. In developing estimating skills, it is important that estimates be recorded before actual measurements are made.

Throughout this unit it is recommended that teachers use the vocabulary of measurement carefully and consistently, to encourage its correct usage by the children. Words such as *length, width, height, depth, capacity, volume, mass, and temperature* will be encountered in this and in subsequent units. Draw the children’s attention to the summary of units and symbols on page 312 and encourage them to refer to it as needed throughout the year. (Note that the preferred symbol for litres is L, not ℓ.) It should be noted that since the units are represented by symbols and not by abbreviations, it is incorrect to include a period as part of the symbol.

Materials

- objects to be used as non-standard units of measurement
- objects whose lengths are to be measured
- unmarked straight edge for each child; a nickel
- pipe cleaner or narrow strip of stiff cardboard and a centimetre ruler for each child
- decimetre strip and 10 centimetre cubes or 10 centimetre squares (cut from page T 364) for each child
- decimetre strips prepared during the lesson activity for pages 106 and 107
- unmarked metre sticks; metre sticks and tape measures marked in centimetres and decimetres
- one or more wall charts for measuring the children’s heights
- containers in a variety of shapes and sizes
- material for pouring (sand, water, rice); funnel
- one litre container labeled “one litre”
- containers suggested on pages 112 and 113, or other similar containers
- milk carton whose length and width are each one decimetre
- mass of one kilogram marked with the label “one kilogram”
- mass of 10 kg such as a pail of stones
- various objects for comparing and finding mass
- kitchen scales and step-on scales that measure mass in kilograms
- objects suggested for Ex. 6-12 on page 115 or similar objects
- thermometers that measure liquid temperature; thermometers that measure air temperature
- meat thermometers, candy thermometers, and clinical thermometers (optional)
- demonstration clock, demonstration thermometer (see page T 127)
- copies of dial clock faces from page T 354

Vocabulary

standard unit	straight edge	perimeter
centimetre (cm)	decimetre (dm)	metre (m)
estimate	capacity	litre
L or ℓ	mass	kilogram (kg)
temperature	thermometer	degrees Celsius (°C)

LESSON OUTCOME

Demonstrate the need for standard units of measurement; measure length in centimetres

Materials

objects to be used as non-standard units of measurement, objects to be measured, centimetre cubes or squares, centimetre rulers

Vocabulary

standard unit, centimetre, cm

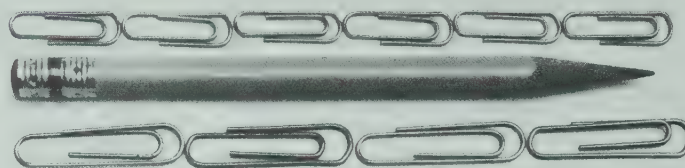
6 MEASUREMENT

Measuring Length in Centimetres

Andy and Michelle used paper clips to measure the pencil.

The pencil is about 6 clips long.

The pencil is about 4 clips long.

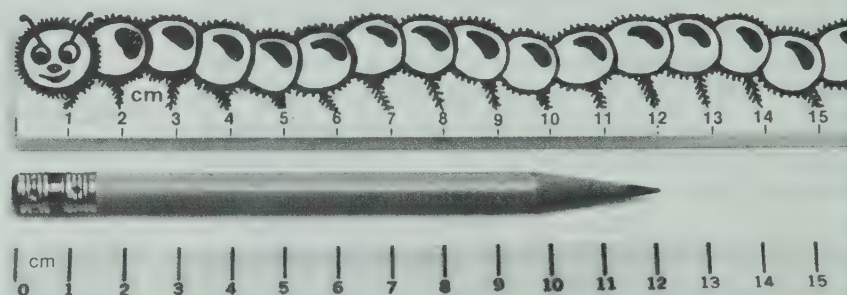


Their results were different because paper clips are not standard units of length.

Pearl and Marlys used rulers marked in centimetres to measure the pencil.

The pencil is about 12 cm long.

I agree.



Their results were the same because centimetres are standard units of length.

A centimetre is the same length anywhere in the world. The symbol, cm, stands for "centimetres".

100

LESSON ACTIVITY

Before Using the Pages

- Begin with an activity period in which the children measure objects such as the width of a table, the length of a book, the height of a bookshelf. Have the children use non-standard units to measure these, for example, erasers, nails, straws, and sticks. Initiate a discussion about the inconsistency of their results.

Using the Pages

- The first illustration of the worked example emphasizes the need for a standard unit of measurement for length. Discuss the fact that a similar situation occurred in the preliminary activity; that is, children obtained different answers because not all sticks, for example, were the same length.

The second illustration introduces the centimetre standard unit of length. Note that the symbol cm centimetres is written without a period. (This is also true of other metric symbols. See the list of symbols on page 3.)

Emphasize that the centimetre is the same length anywhere in the world and suggest that this makes it easy for people to communicate about length.


Using a centimetre cube or a centimetre square may help children understand the concept of a centimetre ruler. Have them observe that it matches each length from one mark to the next for the rulers on the pages and for their own rulers.

Some children may notice that the scale for one of the two rulers pictured at the bottom of page 100 begins with the numeral 0. Explain that the pencil is aligned with mark for 0 on the second ruler, and with the end of the ruler which corresponds to the mark for 0. Have children align their own rulers with the pencil in this illustration.

Working Together


Use the centimetre ruler. Give the length of each object to the nearest centimetre.

1.



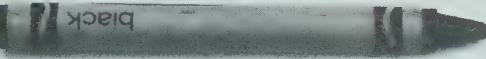
1 cm

2.



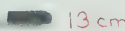
5 cm

3.




9 cm

4.




13 cm




Use a centimetre ruler.
Measure each line segment.

5.



5 cm

6.

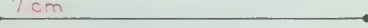


8 cm

Exercises


Use a centimetre ruler.
Measure each line segment.

1.



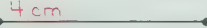
7 cm

2.



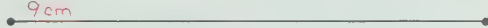
6 cm

3.



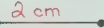
4 cm

4.




9 cm

5.



2 cm

6.



11 cm

Draw line segments having these lengths.

7.

1 cm

8.

3 cm

9.

9 cm

10.


13 cm

11.

17 cm


Is the length closer
to 6 cm or to 7 cm?

12.



6 cm

13.



7 cm

Measure each line segment
to the nearest centimetre.

14.



5 cm

15.



7 cm

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RELATED ACTIVITIES

- Have the children use their centimetre rulers to measure the objects they measured earlier in the lesson activity using non-standard units. This will reinforce the idea that standard units give consistent results.
- Have children cut pictures of objects from magazines and measure each to the nearest centimetre. The pictures may be pasted in a measurement booklet.
- Children may enjoy measuring objects in the classroom with a centimetre ruler. Have them record the name and the length of each object.

Working Together: Ex. 1-4 show a ruler aligned for measuring the length of each object. These exercises concentrate on the skill of reading the scale. For Ex. 5 and 6, the children must align their own rulers to measure the length of each line segment. Have the children include the end points when measuring the length of each line segment. Ask questions such as, "How many centimetres longer is the paintbrush than the clip?"

Exercises: Remind the children to begin measuring from 0 on their rulers, or from the point that indicates 0. Ex. 12-15 illustrate that lengths are not always a whole number of centimetres and, thus, it is often necessary to measure to the nearest centimetre. For example, the line segment for Ex. 13 is slightly shorter than 7 cm, and the line segment for Ex. 15 is slightly longer than 7 cm. However, to the nearest centimetre, each segment is 7 cm in length.

Assessment

Use a centimetre ruler.
Measure each line segment to the nearest centimetre.

1.

(3 cm)
2.

(just less than 6 cm)

Draw line segments having these lengths.

3.

8 cm
4.

15 cm

LESSON OUTCOME

Estimate length in centimetres

Materials

centimetre ruler and an unmarked straight edge for each child, a nickel for Ex. 15

Vocabulary

estimate, unmarked straight edge

Prerequisite Skills

Measure length in centimetres

Checking Prerequisite Skills

Measure each line segment to the nearest centimetre.

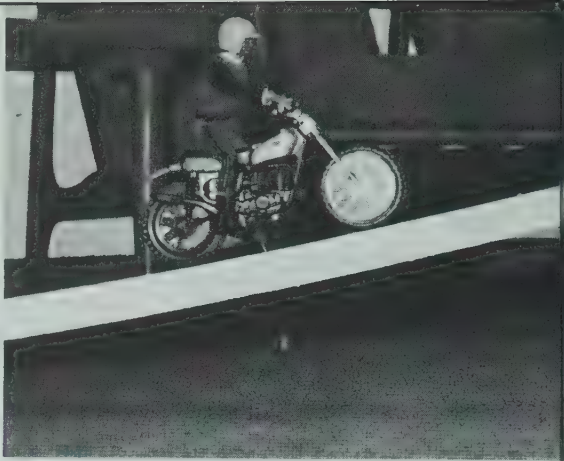
- 1. (8 cm)
- 2. (5 cm)
- 3. (just longer than 12 cm)

Background

In this unit the relationships among centimetres, decimetres, and metres are established. These relationships are shown by starting with the smallest unit and moving to the larger units to parallel the early work with whole numbers and the regrouping of ten ones for one ten.

Estimating Length in Centimetres

The motorcycle can jump about 60 cm. Are the ramps less than 60 cm apart?



Working Together

Which length shown on the chart would be most useful for estimating each of these?

- 1. the height of the room B
- 2. the distance from your desk to the chalkboard C
- 3. the length of the table A

- A. the number of centimetres in your hand span
- B. the number of centimetres in your height
- C. the number of centimetres you walk in one step

Which is the best estimate for the length of this line segment,

4. 2 cm, 12 cm, or 22 cm?

Estimate the length of the line segment. Then measure to check.

5. Estimates will vary. 6 cm

Use an unmarked straight edge.

6. Draw a line segment that you estimate to be 10 cm long. Measure with a ruler to check.

LESSON ACTIVITY

Using the Pages

- Tell the children that often it is helpful to be able to judge a length without using a ruler. Explain that this is called making an *estimate* of the length. An estimate is not a haphazard guess, but a carefully considered opinion.
- The picture illustrates the need to estimate a length arising in a play situation, and demonstrates a method of estimating. Discuss Daryl's way of estimating the distance between the ramps. Have the children measure and write down the number of centimetres in their own hand span as well as other body measurements such as the width of one finger, the width of one hand, or the length of one foot.

Working Together: Exercises such as the first three encourage the children to consider which body measurements are suitable for helping to estimate certain lengths. Discuss these orally and have children suggest other ways of estimating the lengths. For example, the height of a brick

wall might be estimated by knowing the approximate height of one brick and then counting the bricks.

The remaining exercises deal with the skills of estimating length and measuring to check. Note that an unmarked straight edge such as a strip of cardboard or acetate should be used for drawing the line segment for Ex. 6.

Exercises: Have the children prepare the chart for Ex. 1-5, record their estimates before beginning to measure. Since estimating is a challenge for children as well as for adults, do not expect children to estimate exactly. If they are almost correct, they show an understanding of length. The procedure of measuring each length after estimating is important since it enables the children to check their estimates and improve their ability to estimate.

You may need to review the terms *length* and *width* with the children. For Ex. 13 and 14, explain that we usually think of the longer measure as the length and the shorter measure as the width. Answers for Ex. 11-16 could be written in the form of a chart similar to the one suggested for Ex. 1-5.



Daryl knows that his hand span is about 20 cm. This helps him **estimate** that the ramps are less than 60 cm apart.



Exercises

Estimate the length of each line segment. Write each estimate in a table like the one shown. Then measure each line segment and write the measurement in your table.

	Estimate	Measurement
1.	cm	cm
2.	cm	cm

Estimates will vary.

1. 14 cm
2. 7 cm
3. 4 cm
4. 3 cm
5. 10 cm

Use an unmarked straight edge. Draw line segments you estimate to be these lengths. Then measure each line segment to check.

6. 16 cm
7. 6 cm
8. 9 cm
9. 13 cm
10. 5 cm

Estimate each of these. Then measure to check.

11. the length of your desk
12. the thickness of your book
13. the length of this page
14. the width of this page
15. the width of a nickel
16. the height of one stair

Answers will vary for 11-16.

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Assessment

Estimate the length of each line segment. Measure to check.

- 11 cm)
- 2 cm)
- 6 cm)
- 10 cm)

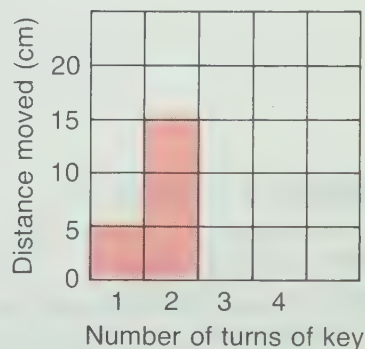
RELATED ACTIVITIES

- Have the children estimate the lengths of objects and record their estimates. Then have them measure the objects to check.
- The accuracy of an estimate is indicated by the difference between the estimate and the measurement. This may be shown in a chart similar to the following.

	Estimate	Measurement	Difference
1.	12 cm	10 cm	2 cm
2.	16 cm	19 cm	3 cm

- A wind-up toy such as a “walking mouse” may be used for the following activity. Mark a starting line on a level surface. Wind the key through one turn and allow the toy to move from the starting line until it stops. Estimate the distance traveled in centimetres and then measure to check. Begin again at the starting line, but wind the key through two turns. Repeat the procedure for as many turns as are allowed by winding the key. The results may be shown in a chart and/or in the form of a bar graph.

	Estimate	Measurement
1.		
2.		



LESSON OUTCOME

Find the perimeter of a shape

Materials

a pipe cleaner or a narrow strip of stiff cardboard, a centimetre ruler for each child

Vocabulary

perimeter

Prerequisite Skills

Measure line segments in centimetres; add more than two one-digit numbers

Checking Prerequisite Skills

Measure each line segment to the nearest centimetre.

1. (5 cm)

2. (9 cm)

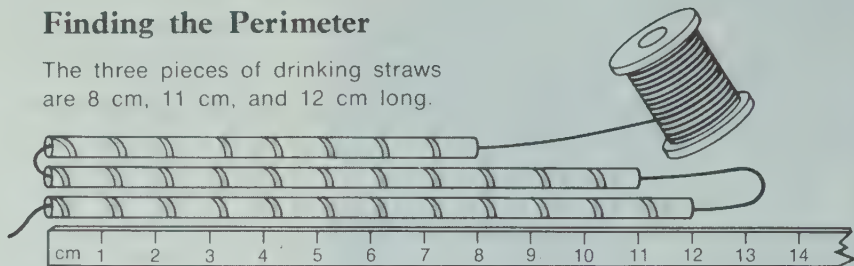
Add.

3. $4 + 4 + 2 + 6$ 16

4. $7 + 8 + 9 + 8$ 32

Finding the Perimeter

The three pieces of drinking straws are 8 cm, 11 cm, and 12 cm long.

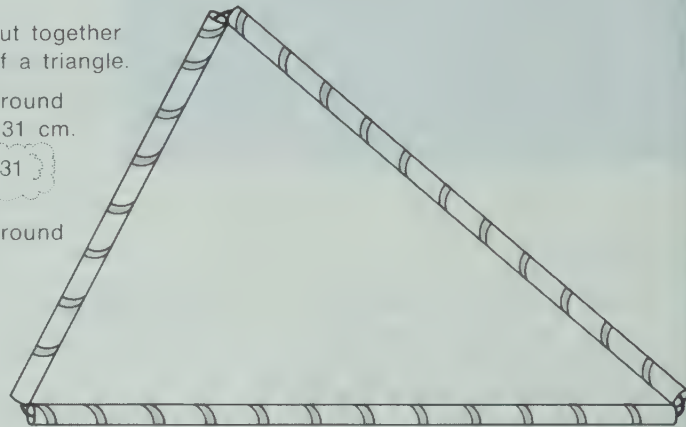


They can be put together in the shape of a triangle.

The distance around the triangle is 31 cm.

$$8 + 11 + 12 = 31$$

The distance around a shape is its **perimeter**.

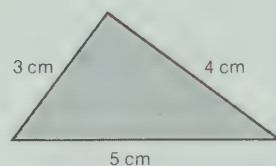


The perimeter of this triangle is 31 cm.

Working Together

Find the perimeter of each shape.

1. 12 cm

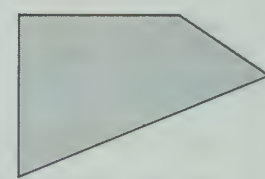


2. 14 cm



Each side is marked in centimetres.

3. 13 cm



Measure each side first.

LESSON ACTIVITY

Before Using the Pages

- Display a narrow strip of cardboard or a pipe cleaner. Align the strip with a centimetre ruler and have the children observe the length of the strip. Bend the strip so that the two ends meet to form a triangular shape. Have a child name the shape. Then ask the children if they can tell you the distance around the shape. Change the shape so that it has a different number of sides and repeat the question. Ask a child to explain why the distance around each shape is the same. Tell them that there is a word that means the distance around a shape. Have them open their texts to page 104 to find the word.

Using the Pages

- The worked example introduces the word *perimeter*. You may wish to discuss the two parts of the word, “peri” means “around” and “meter” means “measure”.

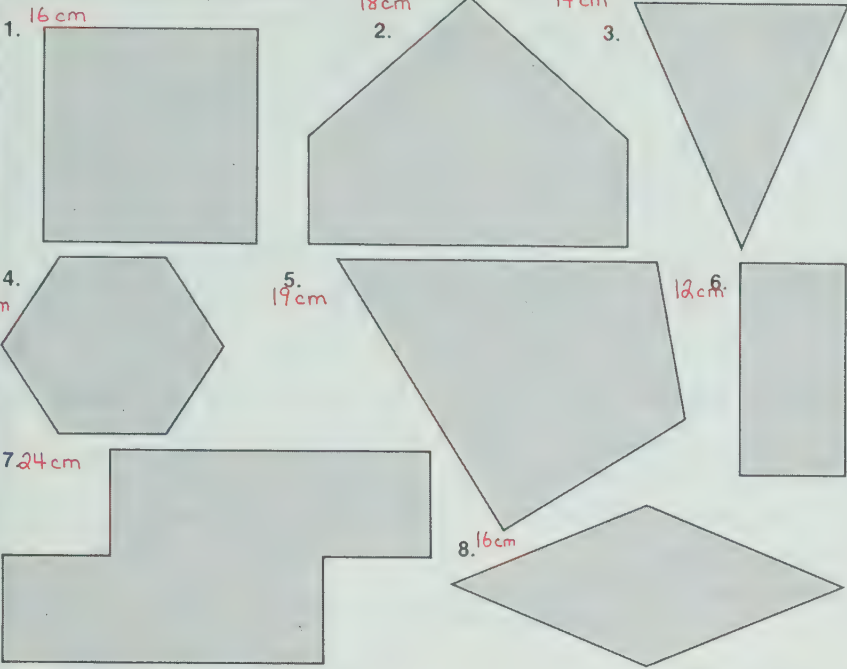
Discuss that the length of each straw is measured and the lengths are added to find the perimeter of the shape. Ask the children to think of a way of finding a perimeter without just one measurement. (Place the three straws end to end against a ruler and read the length.)

Working Together: Ask the children how they could find the perimeter of the shape for Ex. 1. Ask how they could check that the three measurements shown are correct. Have them check the measurements using their own rulers. This helps to develop the skill of measuring line segments that are part of a shape. Have them write the addition sentence and a statement about the perimeter.

Since each side of the shape for Ex. 2 is marked in centimetre units, the concept of perimeter as the distance around a shape can be reinforced. The children can start at any point marked on one side and count the centimetre units around the shape. Show that the same answer is obtained by the addition of four numbers.

Exercises

For each shape, measure each side and find the perimeter.



- Copy these shapes on centimetre grid paper.
1. What is the perimeter of each shape? 16 cm, 16 cm
 2. On your centimetre grid paper, draw other shapes that have the same perimeter as these shapes.
 3. Make up a problem about perimeter to give to a friend.



RELATED ACTIVITIES

- Have the children use straws and string to make geometric shapes similar to the ones shown on page 104. They may trade shapes and find the perimeter of each. Shapes having more than three sides will not be rigid, but children will soon see that this does not change the perimeter.
- Have the children find the perimeter of objects in the classroom. For example, they may measure each edge of a table, a book, or a display board, and then add to find the perimeter. Always have the children estimate before they measure, in order to develop an understanding of the units and to develop the ability to use the units.
- Have children use colored rubber bands to show various shapes on geoboards. Have them copy the shapes on geopaper. Then they may measure the line segments and find the perimeter of each shape.

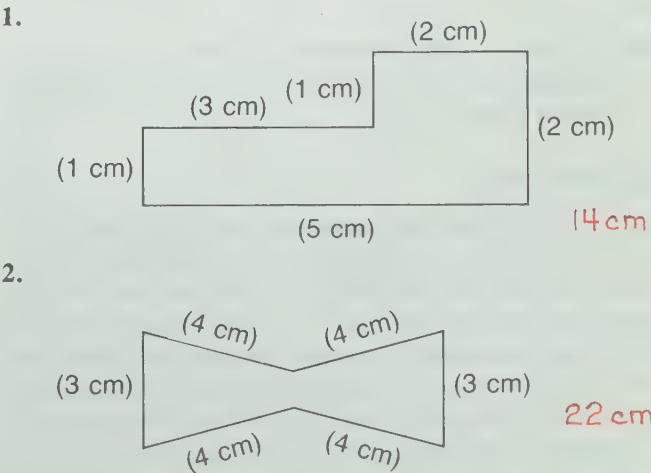
For Ex. 3, have the children write down each measurement as it is found and write the addition sentence with these numbers. Provide similar exercises as needed.

Exercises: Observe the children as they work to ensure that rulers are being aligned correctly. You may wish to ask them which shape they think has the longest perimeter and which shape has the shortest perimeter.

Problem Solving: These exercises help to show that different shapes can have the same perimeter. Since the grid shows centimetres, the children do not need their rulers to find the length of each side for Ex. 1. Provide the children with centimetre grid paper for Ex. 2 and 3. There are many possible shapes for Ex. 2. Have the children use crayons or colored pencils and color inside each shape they draw. Then have them mark the length of each side. The children may wish to share their findings. Their drawings can be displayed for several days.

Assessment

For each shape, measure each side and find the perimeter.



LESSON OUTCOME

Estimate and measure length in decimetres; relate centimetres and decimetres

Materials

decimetre strip and 10 centimetre squares for each child (These can be cut from page T 364.)

Vocabulary

decimetre, dm

Prerequisite Skills

Compare lengths with a given non-standard unit

Checking Prerequisite Skills

1. Name four objects that are longer than your hand span.
2. Name four objects that are shorter than your hand span.

Background

The decimetre is a unit that will have limited use for measuring length. However, this unit is significant when making a comparison between the base ten number system and the relationships among the metric units.

Measuring Length in Decimetres

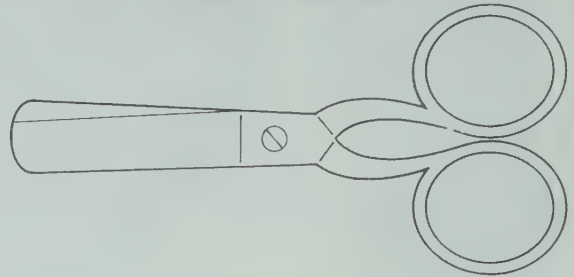
The **decimetre** is a standard unit of length.

This strip is 1 dm long.

1 decimetre or 1 dm

The symbol, dm, stands for "decimetres".

These scissors are about 1 dm long.



Working Together

Use a decimetre strip. Tell if each of these is longer than or shorter than 1 dm.

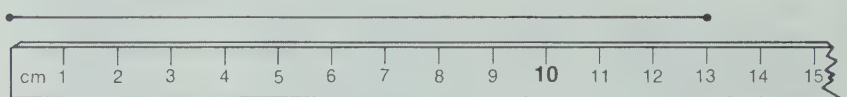
1. a new piece of chalk **shorter**
2. a chalkboard eraser **longer**
3. your foot **longer**
4. your longest finger **shorter**

Complete the table. Estimate first, then measure each to the nearest decimetre.

Estimates will vary.

	Estimate	Measurement
5. the length of this page	dm	about dm 3
6. the width of this page	dm	about dm 2

For this line segment, complete the statement below.



7. The line segment is **13** cm long, or 1 dm and **3** cm.

Complete.

8. 2 dm and 1 cm = **21** cm 9. 35 cm = **3** dm and **5** cm

LESSON ACTIVITY

Before Using the Pages

- Briefly discuss that the centimetre is a small unit of length, and suggest that a larger unit would be more suitable for measuring longer lengths.

Using the Pages

- Read through the worked example at the top of page 106 to introduce the term *decimetre* and the symbol dm. Have a child explain what is meant by the statement that the decimetre is a standard unit of length. Give each child a cardboard decimetre strip. Have the children match their strips with the one shown at the top of page 106. Have them print "1 decimetre or 1 dm" on one side of their strips.
If the children have scissors similar to those shown on the page, have them compare the length of the scissors with a decimetre strip.

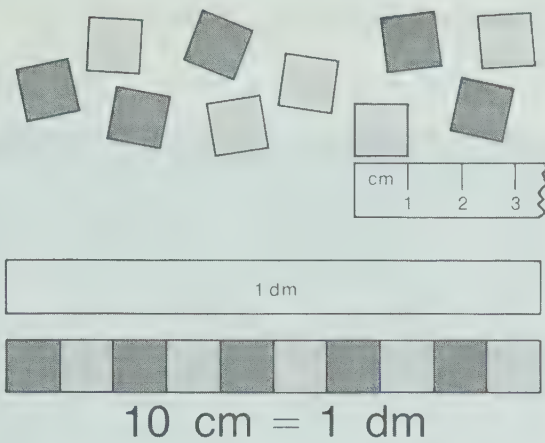
- The children likely will have noticed the similarity between the words *centimetre* and *decimetre*, and the symbols cm and dm. Explain that the two units of measurement are related.
- Read through the worked example at the top of page 107 with the children and discuss the procedure of pasting centimetre squares end to end along the decimetre strip. The children may be interested in trying this procedure for their own decimetre strips. Have them paste the squares on the blank side of their strips and then use two colors of crayon to color the squares.

Working Together: From Ex. 1-6, the children can develop familiarity with the decimetre as a unit of length, and gradually work toward estimating and measuring length in decimetres. The remaining exercises deal with relating the centimetre and the decimetre. Ask why the numeral 10 is emphasized on the centimetre ruler for Ex. 7. The children can place their decimetre strips along the ruler to help them see that the line segment is 1 dm and 3 cm in length. A similar procedure may be used for Ex. 8 and 9.

The sides of these small squares are 1 cm long.

Paste 10 of the squares end to end along the decimetre strip. They will fit exactly.

A length of 10 cm is the same as a length of 1 dm.



Exercises

Look around. What do you see that is about 1 dm in length?

- 1. about 1 dm in length?
- 2. between 1 dm and 5 dm in length?
- 3. between 5 dm and 10 dm in length?

Copy and complete this table. Estimate first. Then measure to the nearest decimetre.

Copy and complete this table.

4.	dm	1	2	?	7
	cm	10	?	40	?

Answers will vary for 5-9.

	Estimate	Measurement
5. the length of your desk	dm	about dm
6. the width of your desk	dm	about dm
7. the height of your desk	dm	about dm
8. the length of your arm from shoulder to finger tips	dm	about dm
9. the length of your leg from knee to heel	dm	about dm

Complete.

- 10. 20 cm = 2 dm
- 11. 24 cm = 2 dm and 4 cm
- 12. 39 cm = 3 dm and 9 cm
- 13. 5 dm = 50 cm
- 14. 5 dm and 3 cm = 53 cm
- 15. 7 dm and 6 cm = 76 cm

RELATED ACTIVITIES

- Cut brightly colored ribbons into various lengths. Have children estimate the length of each ribbon in decimetres and then measure each ribbon.
- Some ribbons may be measured in centimetres and the answer written in two ways; for example, 23 cm, or 2 dm and 3 cm.
- You may wish to have the children write their answers for the perimeters of the shapes on page 105 in terms of decimetres. For example, for Ex. 1, the perimeter is 16 cm, or 1 dm and 6 cm.
- Have children estimate and measure other lengths in the classroom in terms of decimetres and centimetres. Encourage them also to measure objects at home. The results can be written on chart paper and displayed for several days.
- Children would benefit from finding and recording as many objects as possible that are one decimetre long.

Exercises: Encourage the children to check their answers for Ex. 1-3 by measuring with their decimetre strips. If necessary, remind the children about the meaning of the word *between*. For Ex. 2, for example, the required length must be longer than 1 dm but shorter than 5 dm.

Assessment

Estimate first. Then measure to the nearest decimetre.

- the length of the bookshelf
- the height of the bookshelf

Complete.

- 30 cm = 3 dm
- 4 dm and 8 cm = 48 cm

LESSON OUTCOME

Estimate and measure length in metres

Materials

unmarked metre sticks

Vocabulary

metre, m

Prerequisite Skills

Measure length using a large non-standard unit

Checking Prerequisite Skills

How many strides do you take to walk from

- 1. your chair to the door?
- 2. from one side of the room to another?
- 3. from your classroom to the principal's office?

Measuring Length in Metres

The **metre** is a standard unit of length.

The picture shows different ways to remember how long a metre is.



Working Together

In the picture,

- 1. what has a measurement of about 1 m? *There are many answers for 1 and 2.*
Look around. What can you see that is

- 2. about 1 m in length?

Which is the better unit, the metre or the centimetre, for measuring each of these?

- 3. a hair from your head *centimetre*
- 4. a flagpole *metre*

Use a metre stick. Measure to the nearest metre.

- 5. the length of the chalkboard

Answers for 5 and 6 will depend on the classroom.
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Estimate first. Then measure to the nearest metre.

- 6. the distance from one corner of your classroom to another corner

Exercises

Estimate the lengths in metres. Then measure each length to the nearest metre. Write your estimates and measurements in a table like this one.

Object	Estimate	Measurement
	m	about m

LESSON ACTIVITY

Before Using the Pages

- Review the centimetre and the decimetre as suitable units for measuring certain lengths. Discuss the need for a longer unit for measuring distances such as the width of the classroom, the length of the hall, and the perimeter of the schoolyard. Display an unmarked metre stick as an appropriate unit for measuring longer distances and ask whether anyone can recall the name of the unit.

Using the Pages

- The picture presents a familiar environment to introduce the metre as a standard unit of length. Establish which child in the picture is holding the metre stick and have the children use this for reference when suggesting the number of metres in the width of the door, the height of the door, the width of the hockey net, the height of the hockey net, the height of the tall man, the shovel, and the stack of cans.

This discussion will prepare the children for Ex. 1 of *Working Together*.

Working Together: From Ex. 1-6, the children can develop familiarity with the metre and gradually work toward estimating and measuring length in metres. (The fact that one metre is the same length as ten decimetres or one hundred centimetres is left until the next lesson.)

Ex. 1-4 can be discussed orally. After children have suggested answers for Ex. 1, have them count the cans that are stacked together for a height of about one metre. They may also be able to determine that the height of fifteen bricks is about the same as one metre. For Ex. 2, have the child who names an object compare the object with a metre stick. Have the children suggest other examples similar to those in Ex. 3 and 4.

Exercises: Provide the children with metre sticks or metre tape for measuring the suggested lengths. If children are working in pairs to help each other with measuring, ensure that each child writes her/his own estimate. Three or four

The symbol, m, stands for "metres".



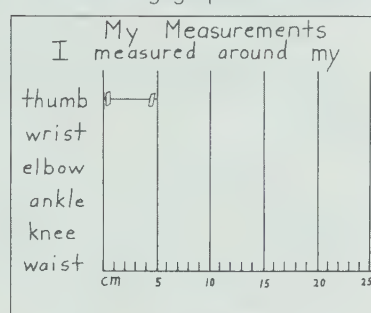
Estimates will vary. Measurements will depend on the classroom.

1. the width of the door
2. the height of the door
3. the length of a bookshelf
4. the length of the bulletin board
5. the width of the hallway
6. the length of the hallway
7. the length of the classroom
8. the width of the classroom

Use some of your answers above to help you find these.
Do not measure again.

9. the perimeter of the door
10. the perimeter of the classroom

Make a string graph.



try
this

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RELATED ACTIVITIES

- Some children may enjoy finding distances such as the number of metres they can throw a ball, the number of metres they walk in ten strides, the number of metres they walk from school to home, and the perimeter of the school yard.
- Have the children compare the length of one metre with the actual objects in the photograph, for example, the height of ten cans, a shovel, a hockey net. If there is a brick wall in the school, have them find the number of bricks required for a height of one metre.
- Have each child cut a piece of string or a strip of cardboard one metre long and use it to measure lengths at home. The results may be displayed and used to generate questions involving comparison of lengths and perimeters of objects.
- My bed is about ____ m long.
- My room is about ____ m long and ____ m wide.
- My window is about ____ m wide and ____ m high.
- Children could estimate and then measure the length and width of the classroom in metres.

groups of children may be arranged to work at different times throughout the day.

This: The string graph introduces children to a method of measuring lengths that are curved rather than straight. Have the children work in pairs for this activity to help each other hold and cut the string. You may wish to use a different color of string for each of the measurements. If large sheets of paper ruled in centimetres are not available, have the children use plain sheets. They may measure the length of each string using a centimetre ruler, tape the string on the paper, and then write the measurement beside the string. The graphs may be displayed for several days during which the results may be examined and discussed.

Assessment

- two things that are about 1 m in length.
- two things that are less than 1 m in length.
- two things that are more than 1 m in length.

LESSON OUTCOME

Compare lengths using metres, decimetres, and centimetres

Materials

decimetre strips prepared during the lesson activity for pages 106-107, unmarked metre sticks, metre sticks and tape measures marked in centimetres and decimetres

Prerequisite Skills

Skip count by tens and hundreds

Checking Prerequisite Skills

Complete the pattern.

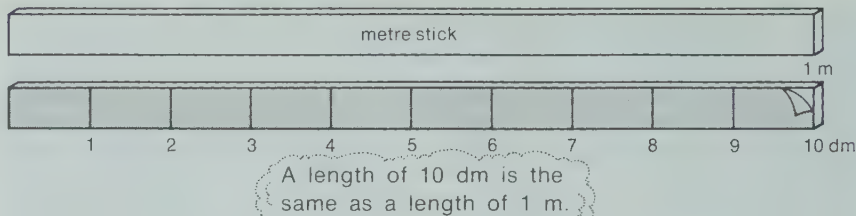
1. 10, 20, 30, 40, 50, 60, 70, 80
2. 100, 200, 300, 400, 500, 600

RELATED ACTIVITIES

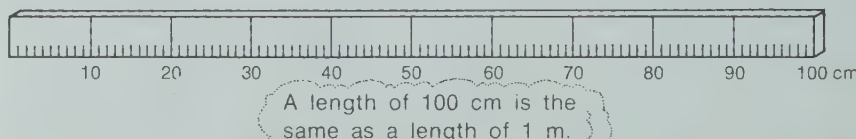
- Have children measure objects in the classroom and express the lengths in more than one way. For example, "The length of the table is 185 cm, or 1 m and 85 cm."
- For the game "Snap" on page T349, prepare cards naming equivalent lengths such as
124 cm, 1 m and 24 cm;
250 cm, 2 m and 5 dm,
2 m and 50 cm, 25 dm.

Metres, Decimetres, and Centimetres

10 decimetre strips can be pasted end to end along a metre stick.



There are 10 centimetres for each of the 10 decimetres.



Working Together

Complete the table.

1.	metres	1	?	3
	centimetres	100	200	?

Name the greater length.

2. 3 m or 210 cm
3. 2 m or 21 dm

Complete.

4. 1 m and 50 cm = 150 cm

5. 206 cm = 2 m and 6 cm

Exercises

Use cm, dm, or m to best complete each sentence.

1. The shoelace is 40 cm long.
2. The swimming pool is 4 m deep.
3. The soup can is 1 dm tall.

Complete.

4. 109 cm = 1 m and 9 cm
5. 259 cm = 2 m and 59 cm
6. 3 m and 24 cm = 324 cm
7. 2 m and 8 cm = 208 cm

Name the greater length.

8. 2 m or 240 cm
9. 12 dm or 2 m

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LESSON ACTIVITY

Before Using the Page

- Display one of the decimetre strips that the children prepared during the lesson activity for pages 106-107. Have children recall pasting centimetre squares end to end along a decimetre strip to demonstrate that 10 cm is the same length as 1 dm. Ask questions such as, "How many centimetres are the same length as three decimetres?"

Using the Page

- The worked example illustrates a method of demonstrating that 10 dm or 100 cm is the same length as 1 m. For a similar procedure, have ten children, in turn, place their decimetre strips end to end along an unmarked metre stick and tape the strips in place. The strips may be placed alternately to show the ten-centimetre face and the face marked "one decimetre". Compare the results with the worked example and with metre sticks marked in centimetres and decimetres.

metres and decimetres. Emphasize that *ten* is the number that relates centimetres to decimetres, and decimetres to metres.

Working Together: These exercises help the children to relate the three units of length and to express a length in terms of one or two units. Demonstrate each exercise using unmarked metre sticks and metre sticks or tape measures marked in centimetres and decimetres.

Exercises: Some children may need to refer to marked metre sticks and tapes. The first three exercises will help determine how well children visualize each unit of length.

Assessment

Name the greater length.

1. 3 m or 25 dm
2. 200 cm or 21 dm

Complete.

3. 136 cm = 1 m and 36 cm
4. 7 m and 63 cm = 763 cm

Practice

Sonya is 129 cm tall. How tall is Sonya in metres and centimetres?

Subtract 100 cm for each metre of height.

$$\begin{array}{r} \text{Subtract } 129 \\ - 100 \\ \hline 29 \end{array} \quad \begin{array}{l} 129 \text{ cm} \\ 100 \text{ cm} = 1 \text{ m} \\ 29 \text{ cm left} \end{array}$$

129 cm = 1 m and 29 cm

Sonya is 1 m and 29 cm tall.



Exercises

Measure how tall you are and complete.

1. I am cm tall. *Answers will vary for 1-4.*
2. I am m and cm tall.

How much will you have to grow to be

3. 160 cm tall?
4. 1 m and 75 cm tall?

Are the two lengths equal?

If not, tell which is greater.

5. 1 m or 85 cm
6. 2 m or 225 cm
7. 1 m or 13 dm
8. 3 m or 30 dm *yes*
9. 7 dm or 63 cm
10. 4 dm or 40 cm *yes*

Complete.

11. 1 m and 15 cm = ¹¹⁵ 1 m and ¹⁵ 15 cm
12. 2 m and 83 cm = ²⁸³ 2 m and ⁸³ 83 cm
13. 320 cm = ³ 3 m and ²⁰ 20 cm
14. 157 cm = ¹ 1 m and ⁵⁷ 57 cm
15. 3 dm and 4 cm = ³⁴ 3 dm and ⁴ 4 cm
16. 59 cm = ⁵ 5 dm and ⁹ 9 cm
17. 1 m and 7 dm = ¹⁷ 1 m and ⁷ 7 dm
18. 22 dm = ² 2 m and ² 2 dm

Solve.

19. Sammy Snail crawls 45 cm. He stops to rest. Then he crawls 32 cm. How many centimetres did he crawl? *77*
20. The path is 1 m wide. Sammy Snail crawls 67 cm. How much farther must he crawl to cross the path? *33 cm*

OBJECTIVE

Demonstrate an understanding of the relationships among centimetres, decimetres, and metres

Materials

one or more wall charts for measuring the children's heights

RELATED ACTIVITIES

- Have children write their names beside the marks for their heights on the wall chart. Keep the charts until the end of the school year. At that time, display the charts again and have the children mark their new heights. Then have them determine how many centimetres they grew in that time.
- Encourage children to keep a chart at home for recording their own heights and the heights of family members and pets.
- The cards described on page T 120 for the game "Snap" could be used for the game "Concentration" on page T 349.

SSON ACTIVITY

ing the Page

Direct the children's attention to the picture. Ask why the numerals for 100 cm and 200 cm are shown in red on the wall chart. Lead the children to suggest that these are special since they mark heights of one metre and two metres. Draw the children's attention to the cat, the dog, and the young child illustrated on the wall chart, and have them suggest the height shown for each. Then ask for the height of the girl standing beside the chart. The children will likely name the height in terms of centimetres.

Read through the worked example and discuss the two ways of naming the height. Then have children show two ways of naming the height for other people pictured on the wall chart.

Exercises: Place one or more charts for measuring height on a wall of the classroom. As the children in turn measure their heights, assist them as needed. Children waiting their turns may begin Ex. 5-20.

LESSON OUTCOME

Estimate and measure capacity in litres

Materials

containers in a variety of shapes and sizes; material for pouring, such as sand, water, rice; funnel; one litre container labeled "one litre"; containers suggested on pages 112 and 113, or other similar containers; milk carton whose length and width are each one decimetre

Vocabulary

litre, L, *ℓ*, capacity

Prerequisite Skills

Measure capacity using non-standard units

Checking Prerequisite Skills

How many cans of water are needed to fill each of these?

1. milk carton
2. jug
3. pail
4. pot

Note: Since the textbook was printed, Metric Commission Canada has adopted the symbol L for litres. Therefore, the answers are given with the symbol L.

Measuring Capacity in Litres

The **litre** is a standard unit for measuring liquids.

The symbol, *ℓ*, stands for "litres".



The green pail holds about 1 *ℓ* of water.

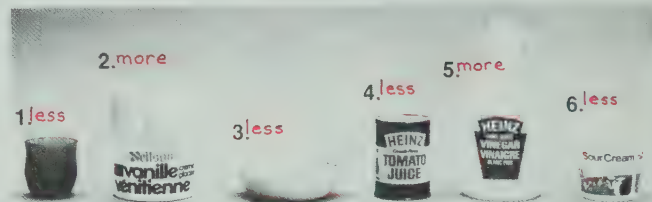
The red pail holds about 10 *ℓ*.

The bathtub half full holds about 100 *ℓ*.

Working Together

Which do you think holds less than 1 *ℓ*?

Which do you think holds more than 1 *ℓ*?



Which do you think holds less than 10 *ℓ*? more than 10 *ℓ*?

7. a gasoline truck *more*
8. a milk jug *less*
9. a swimming pool *more*
10. the kitchen sink *more*
11. an ice cube tray *less*
12. a washing machine *more*

Which of the above do you think holds

13. more than 100 *ℓ*?
a gasoline truck
14. more than 800 *ℓ*?
a gasoline truck
- 112 a swimming pool
- a swimming pool

LESSON ACTIVITY

Before Using the Pages

- Prepare an area of the classroom for activities involving pouring and measuring. Some suggestions are a sink or water table with water, a sand box with sand, and a table with materials such as rice or wheat.

Display a one-litre container marked with the label "one litre". Provide other containers in a variety of shapes and sizes, for example, bottles, cans, pitchers, plastic tubs, and pails. Children may bring some of these from home before the lesson. Include a few containers that hold about one litre, for instance, a coffee can and a milk carton. Have the children use the marked litre container to determine which of the other containers hold more than 1 L, about 1 L, and less than 1 L. Then have them find the number of litres required to fill each of the larger containers. A funnel would be helpful for this activity.

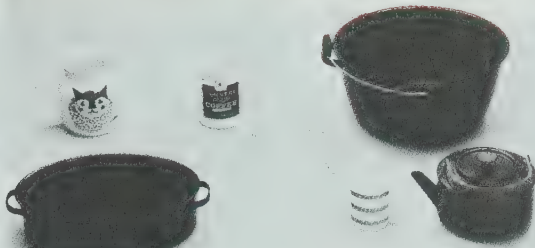
Using the Pages

- Read the introduction and discuss what is meant by statement "The litre is a standard unit for measuring liquids." The picture can motivate a discussion regarding capacity. Have the children read the accompanying statements to themselves and then ask them the following questions.
 - "Which container holds about one litre?"
 - "About how many green pails full of water would it take to fill the red pail? Why?"
 - "If you run water for a bath, how will you know when you have about one hundred litres?"
 - "If you were pouring water into the tub using the red pail, how many pails full of water would you need for about one hundred litres?"
 - "About how many litres of water would there be if you filled the tub?"
 - "Do you think the shampoo bottle above the red pail would hold more than one litre or less than one litre?"

Exercises After the textbook was published, Metric Commission Canada chose the symbol "L" for "litres" in preference to the symbol "ℓ".

1 ℓ of water will fill the coffee can.
How much do you think is needed to fill each of the containers?

1. coffee can	1 ℓ
2. pot 15 L	2 ℓ
3. teakettle 3L	3 ℓ
4. mug less than 1L	4 ℓ
5. fishbowl 4L	5 ℓ
6. roast pan 5L	15 ℓ
7. pitcher 2L	less than 1 ℓ



Copy and complete the table. First, estimate the number of litres needed to fill each container. Then measure each to the nearest litre.

Estimates will vary. Measurements will depend on the containers used.

	Estimate	Measurement
8. vase	ℓ	about ℓ
9. sand pail	ℓ	about ℓ
10. paint can	ℓ	about ℓ
11. large juice can	ℓ	about ℓ
12. soft drink bottle	ℓ	about ℓ
13. large mixing bowl	ℓ	about ℓ

Find an unmarked container that holds more than 1 ℓ.

14. Pour water into the container until you think you have 1 ℓ. Check your estimate by pouring the water into a 1 ℓ container.

Use a large milk carton that is 1 dm long and 1 dm wide. Pour 1 ℓ of water into the carton. Make a mark to show the water level.

15. Measure how high the water reaches. 1 dm

Pour another litre of water into the carton and mark the new water level.

16. Measure how high the water reaches. 2 dm

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RELATED ACTIVITIES

- Some children may have sand pails at home similar to the green pail in the picture. They may wish to bring pails to school and compare the capacity of each with a one-litre container.
- Children could find containers that hold approximately one litre, two litres, or three litres.

Working Together: These exercises encourage the children to view familiar containers in terms of their capacities. If possible, provide containers similar to those in Ex. 1-6 so that the children can verify their answers. For Ex. 7-14, encourage the children to relate to objects in the colored photograph. For example, for Ex. 8, point out that the red pail holds about ten litres and ask whether a milk jug would hold more liquid or less liquid than the red pail. Perhaps children can suggest other familiar containers and relate their capacities to amounts of 1 L, 10 L, or 100 L. An aquarium in the classroom, for instance, might hold about 10 L of water.

Exercises: Since the symbol for litres has been changed to L, have the children write their answers with the symbol L. Ex. 1-7 may be answered in any order. Children will likely find it easier to determine first which container holds less than 1 L and which holds about 15 L, and proceed from there.

If the objects suggested for Ex. 8-13 are not readily available, replace them with others that are similar. Using an unmarked container made of transparent material for Ex. 14 enables the children to judge more easily when they have about one litre of water. This exercise may be repeated several times for different unmarked containers, to help children develop a feeling for the amount of water in one litre. Ex. 15 and 16 enable the children to discover that one litre of water will fill a container that is 1 dm long, 1 dm wide, and 1 dm high.

Assessment

Name a container that holds

1. less than 1 L.
2. about 1 L.
3. more than 10 L.
4. more than 100 L.

LESSON OUTCOME

Estimate and measure mass in kilograms

Materials

mass of one kilogram marked with the label "one kilogram", mass of ten kilograms such as a bucket of stones, various objects for comparing and finding mass, kitchen scales that measure mass in kilograms, step-on scales that measure mass in kilograms, objects suggested for Ex. 6-12 on page 115 or similar objects

Vocabulary

mass, kilogram, kg

Prerequisite Skills

Measure mass using non-standard units and balance scales

Checking Prerequisite Skills

How many pennies are needed to balance each of these?

- 1. spoon
- 2. ruler
- 3. pencil
- 4. small stone
- 5. sponge

Measuring Mass in Kilograms

The kilogram is a standard unit for measuring mass.

The symbol, kg, stands for "kilograms".

You know how heavy something is when you know its mass.



A large cheese wheel has a mass of 100 kg. Suzie is sitting beside 10 kg of cheese. Marc is holding 1 kg of cheese.

Working Together

Without measuring mass, how can you tell **Answers will vary for 1-5.**

1. which of two objects is heavier?

Look around. What do you see with a mass that is

- 2. less than 1 kg?
- 3. about 1 kg?
- 4. about 10 kg?
- 5. more than 10 kg?

Which is the best estimate for the mass of

- 6. a Thanksgiving turkey? 1 kg. **10 kg** or 100 kg
- 7. a Halloween jack-o'-lantern? **6 kg**, 60 kg, or 600 kg

LESSON ACTIVITY

Before Using the Pages

- To begin a discussion of mass, have children name objects in the classroom that they think are heavy and objects that they think are light. Ask them to name the heaviest and the lightest objects in the classroom. Ask if they know a way of measuring how heavy an object is. They will likely suggest using scales. Explain that this is called measuring the *mass* of an object.
Use kitchen scales that measure mass in kilograms. Point to the large numerals for 1 kg, 2 kg, and so on. Display a mass of 1 kg marked with the label "one kilogram". Place the mass on the scales and point out that the indicator stops at the large numeral 1. Have children in turn lift the one-kilogram mass to determine how heavy it seems. Discuss whether one hand or two hands are needed to lift the mass.
Discuss foods that can be bought by the kilogram in grocery stores and supermarkets.

Using the Pages

- The picture lends itself to a discussion that large masses of cheese are stored in a distributor's warehouse and later cut into portions of smaller mass to be sold to grocery stores.
Read the statements that accompany the picture. Remind the children that since they lifted a one-kilogram mass earlier, they know how it would feel to lift Marc's piece of cheese. Ask if they think Suzie's ten-kilogram mass of cheese would be easy to lift. Have available a ten-kilogram mass such as a pail of stones and ask children to lift it. If the kitchen scales can measure masses of ten kilograms, place the pail of stones on the scales and have the children observe that the indicator stops at the large numeral 10. Ask for the mass of one large cheese wheel and then ask for the mass of Suzie's "cheese chair" (three cheese wheels).
- Working Together:** These exercises encourage the children to think of objects in their environment in terms of mass. Guide the children in an oral discussion for the exercises.

Exercises

Do you know your own mass? *Answers will vary for land 2.*

- Estimate it in kilograms.
- Use scales. Measure your mass to the nearest kilogram.

Which is the best estimate for the mass of each of these?

- 

1 kg, 10 kg, or 100 kg
- 

1 kg, 10 kg, or 100 kg
- 

1 kg, 10 kg, or 100 kg

Copy and complete the table. First, estimate each mass in kilograms. Then measure each to the nearest kilogram.

Estimates will vary. Measurements will depend on the objects used.

		Estimate	Measurement
6.	telephone book	kg	about kg
7.	brick	kg	about kg
8.	a bag of sand	kg	about kg
9.	a bag of marbles	kg	about kg
10.	a large can of tomato juice	kg	about kg
11.	10 thick books	kg	about kg
12.	2 l of milk	kg	about kg

Add or subtract.

1. $\begin{array}{r} 7 \\ -4 \\ \hline 11 \end{array}$	2. $\begin{array}{r} 11 \\ -8 \\ \hline 3 \end{array}$	3. $\begin{array}{r} 3 \\ +9 \\ \hline 12 \end{array}$	4. $\begin{array}{r} 12 \\ -5 \\ \hline 7 \end{array}$	5. $\begin{array}{r} 7 \\ +8 \\ \hline 15 \end{array}$	6. $\begin{array}{r} 15 \\ -6 \\ \hline 9 \end{array}$	7. $\begin{array}{r} 9 \\ +5 \\ \hline 14 \end{array}$
8. $\begin{array}{r} 14 \\ -8 \\ \hline 6 \end{array}$	9. $\begin{array}{r} 6 \\ +4 \\ \hline 10 \end{array}$	10. $\begin{array}{r} 10 \\ -3 \\ \hline 7 \end{array}$	11. $\begin{array}{r} 7 \\ +6 \\ \hline 13 \end{array}$	12. $\begin{array}{r} 13 \\ -8 \\ \hline 5 \end{array}$	13. $\begin{array}{r} 5 \\ +4 \\ \hline 9 \end{array}$	14. $\begin{array}{r} 9 \\ -3 \\ \hline 6 \end{array}$
15. $\begin{array}{r} 6 \\ +6 \\ \hline 12 \end{array}$	16. $\begin{array}{r} 12 \\ -7 \\ \hline 5 \end{array}$	17. $\begin{array}{r} 5 \\ +8 \\ \hline 13 \end{array}$	18. $\begin{array}{r} 13 \\ -4 \\ \hline 9 \end{array}$	19. $\begin{array}{r} 9 \\ +6 \\ \hline 15 \end{array}$	20. $\begin{array}{r} 15 \\ -8 \\ \hline 7 \end{array}$	

KEEPING SHARP

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RELATED ACTIVITIES

- Have children estimate and measure the mass of various objects in the classroom, to the nearest kilogram.
- Fill one-litre containers with different materials such as water, rice, beans, and sand. Have children estimate and then measure the mass of each to the nearest kilogram.
- Have the children use the scales to answer questions similar to the following.

“How many apples are needed for a mass of 1 kg? 3 kg?”

“How many grapefruit are needed for a mass of 1 kg? 10 kg?”

- Children may enjoy finding and then listing objects that have a mass of 1 kg. This list could be displayed.

For Ex. 1, emphasize that although holding one object in each hand enables you to determine which object is heavier, it does not tell you the mass of each object. Have children use kitchen scales to verify the mass of each object suggested for Ex. 2-4.

Exercises: Have children use the step-on scales to measure their own masses for Ex. 2. Ensure that the scale is set at zero before the children use it, and that the children have recorded their estimates for their own masses for Ex. 1.

While waiting for a turn at the scales, children may begin the other exercises. Some children may need assistance with Ex. 3-5. The following questions may be helpful.

“Can you lift a toaster with one hand?”

“Can you lift a vacuum cleaner with two hands?”

“Can you lift a refrigerator?”

Objects suggested for Ex. 6-12 may be replaced by others that are available.

Keeping Sharp: These exercises enable the children to practice basic addition and subtraction facts. If you wish to have them write their answers without copying the exercises, have them write the numerals 1 to 20 on paper, leaving room for the answers. Caution them to observe whether they are to add or to subtract.

Assessment

Which is the best estimate for the mass of

- a desk telephone? 2 kg, 20 kg, 200 kg
- a pony? 1 kg, 10 kg, 100 kg
- a child's wagon? 1 kg, 10 kg, 100 kg

Estimate the mass of each. Then measure each to the nearest kilogram.

- a pair of skates
- a bag of plasticine

LESSON OUTCOME

Read a thermometer and record the temperature in degrees Celsius

Materials

demonstration thermometer (optional — see *Related Activities*); some thermometers that measure air temperature and others that measure liquid temperature; other thermometers such as meat thermometers, candy thermometers, and clinical thermometers

Vocabulary

temperature, thermometer, degrees Celsius, °C

Prerequisite Skills

Associate outdoor activities with weather conditions that are hot, warm, cool, or freezing

Checking Prerequisite Skills

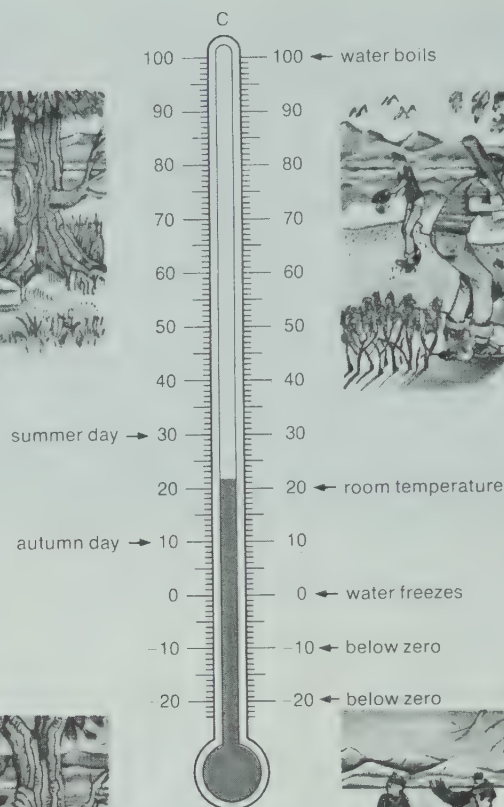
Tell if the weather is usually hot, warm, cool, or freezing for each of these outdoor activities.

1. swimming **hot**
2. skating **freezing**
3. raking leaves **cool**
4. playing baseball **warm**

Measuring Temperature in Degrees Celsius

The **degree Celsius** is a standard unit of temperature.

The symbol, °C, stands for "degrees Celsius".



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LESSON ACTIVITY

Before Using the Pages

- Begin by asking the children if today's weather is hot, warm, cool, or cold. Discuss that these words are relative because people's impressions differ. What seems cool for one person, may seem warm for another. Review that there are standard units for measuring and comparing length, capacity, and mass. Ask what can be used to measure how warm or how cool the weather is today. Elicit the words *thermometer*, *temperature*, and *degrees*.

Using the Pages

- The illustration shows a thermometer that measures temperature in degrees Celsius (°C). Read the introductory statements with the children and allow them a few moments to look at the page. Direct their attention to the upper left illustration and ask what season of the year is shown. Have them give reasons for their answers. Ask what the

temperature might be for a hot summer day. The remaining seasons of the year are shown in a counterclockwise direction on the page. Discuss each of these in a similar manner. If you have a cardboard demonstration thermometer, have children move the ribbon so that the red line shows the temperature suggested for each season.

- Provide the children with thermometers that measure a temperature. Have them note that the scale does not show as great a range of temperatures as the thermometer illustrated on the page. Discuss the reason for this. (The hottest temperature ever recorded on the earth was 58°C in Libya in 1922.) Discuss which kinds of thermometers would show different ranges, such as a clinical thermometer, a candy thermometer, and a meat thermometer. If possible, display some of these for the children to observe.

Working Together: Discuss Ex. 1 and 2 orally and demonstrate using the thermometers. The children may place the thermometers in direct sunshine, in the shade, over a heating register, or by an open window. Ex. 3-7 deal with the skill of reading the scale on the thermometer. For Ex. 1

Working Together

Does the liquid in a thermometer move up or move down

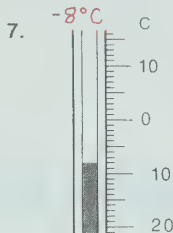
1. ^{up} as the weather becomes warmer?
2. ^{down} as the weather becomes cooler?

Tell how many degrees there are

3. from one numeral to the next. **10**
4. halfway from one numeral to the next. **5**
5. from one mark to the next. **1**



Give each temperature.



Exercises

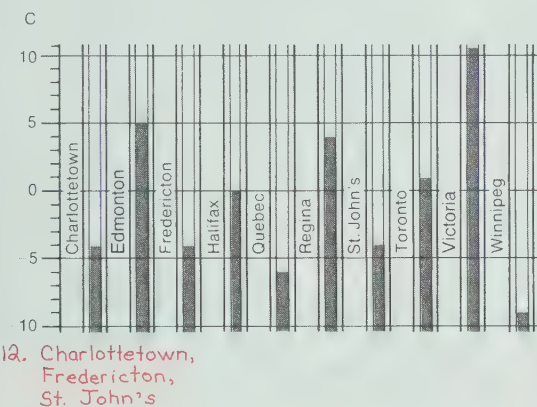
Choose the best temperature for each of these.

1. water boiling in a kettle **100°C**
2. a cup of hot chocolate **70°C**
3. outdoor skating **-10°C**
4. outdoor swimming **27°C**
5. raking leaves **10°C**
6. cold milk **4°C**

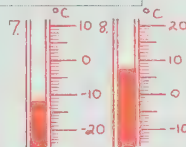
Draw and mark a thermometer to show each temperature.

7. **-12°C**
8. **7°C**
9. **32°C**
10. **54°C**

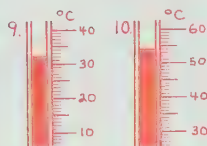
One day in February, thermometers looked like this across Canada.



-10°C	4°C
10°C	27°C
70°C	100°C



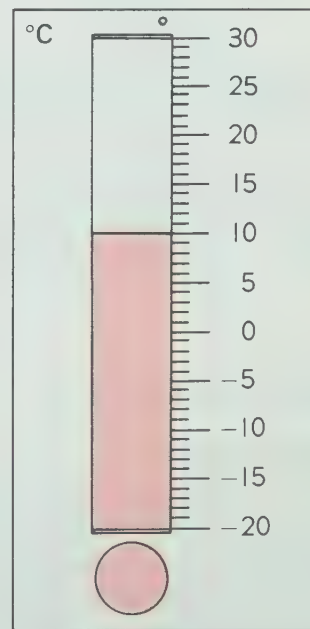
11. Which city was coldest? **Winnipeg**
12. Which cities had equal temperatures?
13. How many degrees warmer was Victoria than Edmonton? **6**
14. Were more of the temperatures above zero or below zero?



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RELATED ACTIVITIES

- Have children keep a record of the outdoor temperature measured at the same time each day. The results may be shown in a graph.
- Children may use temperatures listed in newspapers for cities in Canada to prepare a graph similar to the one on page 117.
- To prepare a demonstration thermometer, draw the outline of a thermometer on a large sheet of cardboard. Mark the scale from 10 or 20 below zero to 30 above zero. Choose a piece of red ribbon and a piece of white ribbon such that each piece is slightly longer than the scale of the thermometer. Glue or sew one end of the red ribbon to one end of the white ribbon. Thread the free end of the white ribbon through a slit at the top of the thermometer and the free end of the red ribbon through a slit at the bottom of the thermometer. Fasten these two ends behind the cardboard to make the ribbon into a movable loop. A temperature can be represented simply by moving the red edge to the appropriate mark on the scale.



the temperature would be read "eight degrees below zero Celsius". When children seem able to read the scale, have them use appropriate thermometers to measure the temperature outdoors, indoors, and the temperatures of various liquids.

Exercises: Give the children copies of number lines from page T 359 to mark as thermometers for showing their answers to Ex. 7-10.

A straight edge may be helpful for reading the temperatures on the graph at the bottom of page 117.

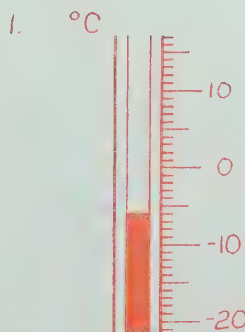
Assessment

Mark a thermometer to show each temperature.

1. **-6°C**
2. **18°C**

Choose the best temperature for each.

- A glass of cold water **-3°C, 3°C, 13°C**
- A warm bath **10°C, 40°C, 90°C**



LESSON OUTCOME

Show times and write numerals and words for times at one-minute marks

Materials


demonstration clock; copies of dial clock faces from page T 354


Prerequisite Skills

Show times at five-minute marks; write numerals and words for times shown

Checking Prerequisite Skills

Write the time using numerals.

1.  8:13

2.  11:05

Write the time using words.

3. 6:25
six twenty-five

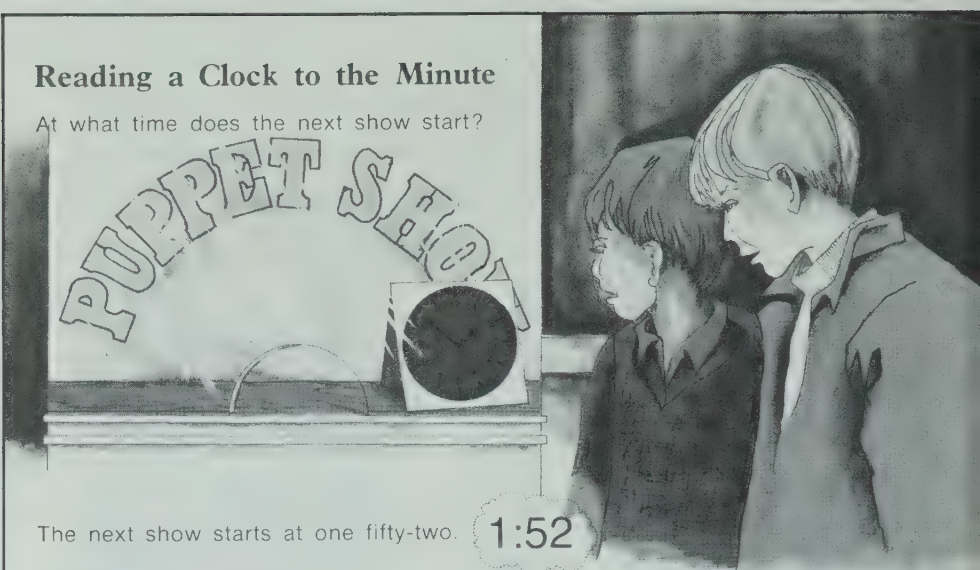
4. 8:00
eight o'clock

5. 7:05

6. 4:50

Reading a Clock to the Minute

At what time does the next show start?



The next show starts at one fifty-two.


1:52


Working Together

The short hand is the hour hand.
The long hand is the minute hand.


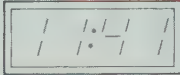
1. Look at the hour hand.
What hour has it just passed? 10
2. Count by fives and then by ones to read the minute hand. How many minutes does it show? 23
3. What time does the clock show?
ten twenty-three
4. Write the time using numerals. 10:23
5. Write the time using words. ten twenty-three



What time is it?

6.  12:17 or twelve seventeen

7.  3:08 or three-o-eight

Show each time on a dial clock and write the time using words.

8.   eleven forty-one

9.   two fifty-four

LESSON ACTIVITY


Using the Pages

- Ask the children if they have heard times stated as one-o-seven, four twenty-three, and six forty-one. Some children may have encountered times to the minute in a situation similar to the one shown on the page. Others who have traveled by bus, plane, or train may recall that arrival and departure times are named to the minute. Encourage the children to share their experiences about such occasions.

Working Together: Ex. 1-5 establish the steps of telling time to the minute. These are similar to the steps suggested in Unit 1 for time to the five-minute marks. However, for Ex. 2 it becomes necessary to count by ones after counting by fives for the minute hand. After completing Ex. 5, guide the children through the same steps to determine the times shown for Ex. 6 and 7. Other similar exercises may be provided by showing times on the demonstration clock. For

Ex. 8 and 9, provide the children with copies of dial clock faces from page T 354. Use as many similar examples as necessary.

Exercises: Provide the children with copies of the dial clock faces on page T 354 for Ex. 13-16.

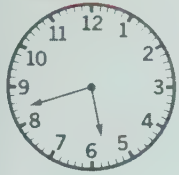
5. 

6. 

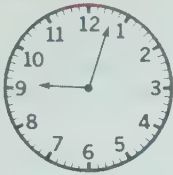
Exercises

Write the time using numerals.

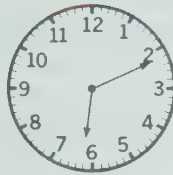
1. 5:42



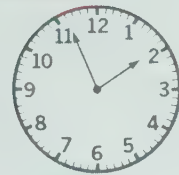
2. 9:03



3. 6:11



4. 1:56



5. 11:29



6. 3:38



7. 7:54



8. 4:37



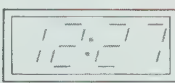
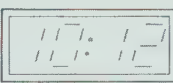
Write the time using words.

9. two thirty-eight

10. four forty-three

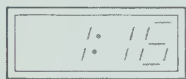
11. ten twelve

12. twelve twenty-seven



Draw dial clocks that show these times.

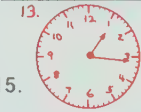
13.



14.



15.



16.



Some dial clocks do not show numerals. What time is shown?

17.



18.



19.



20.



8:00 or eight o'clock

8:20 or eight twenty

8:32 or eight thirty-two

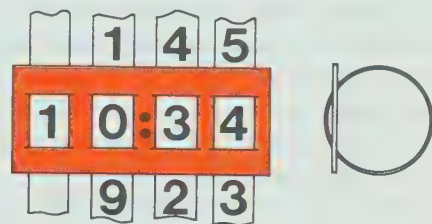
8:58 or eight fifty-eight

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RELATED ACTIVITIES

- Children may select times from schedules for buses, trains, and airplanes to show on dial clocks and write them using words. You may ask questions such as, "At what time does the first plane to Thunder Bay leave on Saturday?" "If the flight lasts for one hour, when will the plane arrive?"

- Some children may wish to make a simple form of a digital clock. Four strips of paper showing the necessary numerals are threaded into slits in a rectangular sheet of paper. The ends of the strips are joined to form four movable loops. One child may show a time on a paper-plate clock face and a partner may show the numeral for the time on the digital clock.

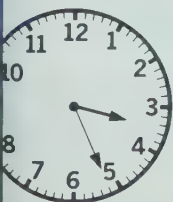


- At different times throughout the day, have children read the time on the classroom clock.

- You may wish to discuss other ways of naming times on a dial clock, for example, half past two, a quarter past one, a quarter to six, and seven minutes to nine.

Assessment

Write the time using numerals.



3:26

2.



10:07

Write the time using words.

5:49

4. 12:12

five forty-nine twelve twelve

Now show the time on a dial clock.

4:02

6. 8:51



OBJECTIVE

Determine whether answers to problems are reasonable

RELATED ACTIVITIES

- Encourage children to think about real-life situations for which they are able to decide whether a fact is probably right or wrong. These situations may occur by chance or you may find opportunities to direct the children's attention to them.
 - Encourage children to think about their answers to word problems they answer in the text and to decide whether their answers are probably right or wrong.
 - Prepare two sets of cards. One set will show pictures of items that can be bought; the other set will show a variety of prices. The cards are placed face down in two piles and the top cards from the two piles are turned over at the same time. The child states whether the price is probably right or wrong and gives a reason.
- Other sets of cards may be made for length, capacity, and mass. These cards may be used by turning up a picture card and then turning up a measurement card. Continue to turn up measurement cards until a correct match is made. For each card turned up, a reason should be given why it is wrong or why it is right.

LESSON ACTIVITY

Using the Page

- Tell the children that often, if we stop to consider whether or not an answer to a problem makes sense, we can tell if the answer is probably right or probably wrong.
- Read the worked example with the children and discuss the reason that explains why Bill's answer is probably wrong. Some children may be able to suggest different reasons for suggesting why Bill's answer is probably wrong. Some children may recall a specific occasion when they made a mistake in their work, but discovered their error because the answer did not make sense. If so, encourage them to tell about it at this time.

Does the Answer Make Sense?

If your answer does not make sense, there may be a mistake in your work.

Example: In a problem, the question asked was, "How tall is Steve's older brother?"

Abby's answer was 2 m.
Bill's answer was 20 m.

Bill's answer is probably wrong, because a person 20 m tall would be taller than a house!

Which answer is probably wrong? Tell why. *Reasons will vary.*

The question asked was	The answers were	
1. How many marbles were in her pocket?	A: 53 marbles	B: 530 marbles
2. How wide is the room?	A: 10 cm	B: 10 m
3. How many cookies did each child eat?	A: 30 cookies	B: 3 cookies
4. How heavy is the baby?	A: 40 kg	B: 4 kg
5. What was the temperature outside?	A: 20°C	B: 68°C
6. How many children are there in both classes?	A: 5 children	B: 50 children
7. How much milk did Minnie buy at the store?	A: 3 l	B: 30 l
8. How much did the toy airplane cost?	A: \$25	B: 25¢
9. What is the date of Eva's birthday?	A: February 30	B: March 2

PROBLEM SOLVING

Exercises: Remind the children that, for each question, they are to give a reason that explains why the answer they chose is probably wrong. If you wish, this aspect of the exercises may be considered orally so that children may share their reasons.

In discussing the answers you may also wish to have the children tell why the other answer of each pair makes no sense.

Checking Up

Use a centimetre ruler. Measure each line segment to the nearest centimetre.

1. 4cm
2. 9cm

Use a centimetre ruler. Measure the sides and find the perimeter of each shape.

3. 16cm
4. 17cm

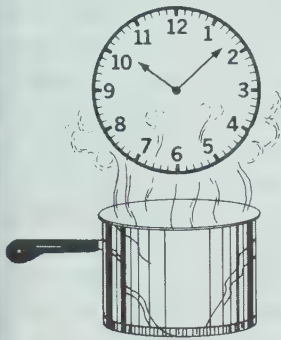
Which is the better unit, the centimetre or the metre, for measuring each of these?

5. the height of a tree metre
6. the length of a belt centimetre
7. the width of a refrigerator centimetre
8. the length of a garden hose metre

Complete.

9. 1 m = 100 cm
10. 4 dm = 40 cm
11. 87 cm = 8 dm and 7 cm
12. 2 m and 35 cm = 235 cm
13. 142 cm = 1 m and 42 cm
14. 3 m and 2 cm = 302 cm

Choose the best estimate for each measurement.



15. the mass of the cooking pot
5 kg, 50 kg, or 500 kg
16. the amount of hot soup in the pot
8 l, 80 l, or 800 l
17. the temperature of the hot soup
8°C, 48°C, or 88°C
18. the height of the cooking pot
2 cm, 20 cm, or 200 cm

Write

Draw

19. the time shown on the dial clock.
10:08 or ten-o-eight
20. a dial clock that shows 3:42.



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OBJECTIVE

Demonstrate an understanding of the concepts and skills presented in this unit

RELATED ACTIVITIES

- Leave measuring equipment such as rulers, scales, thermometers, and containers on display for the children to use frequently. Instructions for activities suggested in *Related Activities* for Unit 6 could be placed with the measuring equipment.
- Children may list objects they would measure in centimetres, objects they would measure in decimetres, and objects they would measure in metres. These lists could be displayed.
- Children may enjoy discovering what they can do in one minute. For example, one child could count the claps that another child can make in one minute.

Exercises	Related Pages
Measure in centimetres	1, 2 T 110-T 111
Find the perimeter	3, 4 T 114-T 115
Use different units of measurement	5-8 T 120
Compare metres and centimetres	9, 12-14 T 120
Compare decimetres and centimetres	10, 11 T 116-T 117
Measure mass	15 T 124-T 125
Measure capacity	16 T 122-T 123
Measure temperature	17 T 126-T 127
Measure length in centimetres	18 T 112-T 113
Measure time	19 T 128-T 129
Measure time	20 T 128-T 129

Comments

Provide each child with a centimetre ruler for Ex. 1-4 and a copy of a dial clock face from page T 354 for Ex. 20.

Children must remember to measure each side of the shapes for Ex. 3 and 4.

If errors occur in Ex. 1 and 2, children may not be placing their rulers with the mark for 0 at the end of the object being measured.

If Ex. 5-8 or Ex. 15-18 present difficulties, more experience in measuring with the appropriate unit may be necessary.

Activities suggested on page T 117 may be used if errors in Ex. 10 and 11 indicate need for a better understanding of the relationship between decimetres and centimetres.

Unit 7 Overview

Decimals

This unit brings together two familiar concepts in what is likely the children's first formal introduction to decimals. The concepts of part of a whole and, later, place value are used to develop an understanding of decimals to 9.9. The presentation builds on the concept of ten equal parts of a whole. It is developed that a decimal numeral can show the number of wholes and the number of tenths of another identical whole. The actual content of this unit is limited in order that emphasis can be given to developing an understanding of the concept of wholes and tenths, and decimal notation.

Just as concrete models helped in developing whole number concepts, so concrete models for decimals will play an important role in helping children to understand decimals and operations with them. Decimals are also related to points on the number line, and this helps with comparing and ordering decimals. Place value for tenths and wholes is examined prior to the addition of decimals. (The addition involves regrouping 10 tenths as 1 one.) The unit concludes with an application of decimals in measurement, involving the relationship that one decimetre is the same length as ten centimetres.

Prerequisite Skills

- demonstrate an understanding of the relationship between centimetres and decimetres
- add two-digit numbers with regrouping

Unit Outcomes

- read and write decimal notation from 0.0 to 9.9
- match decimals with points on the number line
- compare and order decimals from 0.0 to 9.9
- understand place value for ones and tenths
- regroup with decimals and solve related word problems
- add decimals with regrouping, sums to 9.9
- express decimetres as centimetres and centimetres as decimetres using decimals

Background

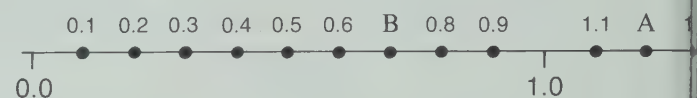
In Unit 2, children encountered fractions, both less than one and greater than one, for wholes that were divided into 2, 3, 4, or 10 equal parts. Numerals such as $\frac{3}{4}$ and $5\frac{1}{2}$ were used. However, to represent fractional parts, decimals are very convenient and much more efficient than fractions. For these reasons, decimals are used widely in science and in industry and have greatly influenced the development of systems of money and of measurement.

The use of decimals is dependent on tenths, that is, ten equal parts of a whole. Children begin by learning that an amount less than one (part of a whole) can be named by a decimal if that amount is expressed in tenths. Considerable emphasis is given to recognizing that the whole must have ten parts and that the parts must be equal (see the exercises on page 123). Later, it is seen that a decimal can also name an amount equal to or greater than one, by naming the number of wholes and the number of tenths of another whole. At this time, the significance of 0 in a numeral such as 0.4 can be understood more readily. When it is seen that a numeral such as 2.4 represents 2 wholes and 4 tenths, it can be understood that 0.4 represents 0 wholes (ones) and 4 tenths.

Thus, the decimal point itself is seen as separating the whole from the parts of a whole, or the ones from the tenths (the amount to the right of the decimal point is less than one).

Note that the concept of a whole being divided into 10 equal parts is continually being reinforced by the way in which decimal numerals are read. For example, 6.3 is read "six and three-tenths", and 0.7 is read "seven-tenths" or "zero and seven-tenths". In other words, the decimal point is read "and" and the one-place decimal is read using the word "tenths".

Matching decimals with points on the number line helps comparing and ordering decimals. The line segments between whole number positions are divided into 10 equal parts as children associate decimals with the new points. For example, since 1.2 is 1 whole and 2 of 10 equal parts, it is associated with point A in the diagram below, and since 0.7 is 0 wholes and 7 of 10 equal parts, it is associated with point B.



Note that the whole number positions themselves are renamed by decimals; for instance, 1 is shown as 1.0. By relating decimals to points on the number line, children can see, for example, that 2.1 is greater than 1.7 (or 1.7 is less than 2.1); that 2.1 is closer to 2 than to 3; that 0.9 and 1.1 are each close to 1, and, in fact, are the same distance from 1; and that 0.5 is halfway between 0 and 1. Besides providing greater familiarity with decimals, these concepts are important for work with estimation involving decimals.

Regrouping tenths and ones requires the same process as regrouping ones and tens; for instance, 32 ones is the same as tens 2 ones. Similarly, 32 tenths is the same as 3 ones 2 tenths. Concrete models and the number line are helpful in developing this concept. The work is facilitated by the fact that one-place decimals have been read using the word "tenths".

Learning the place-value aspect of decimals makes it possible to present addition as an extension of regrouping. Thus, it is necessary for decimals to be expressed as fractions with denominators of ten to explain the algorithm. The same skills used in addition of whole numbers with regrouping are applied in addition of decimals with regrouping. The numbers are arranged in vertical form with their places, and thus the decimal points, lined up. Addition is performed in a right-to-left order beginning, in this case, with the tenths and then the ones. Children who understand the concept of place value for whole numbers can readily apply the regrouping procedure to the situation of regrouping 10 tenths as 1 one.

1	1
37	3.7
+ 15	+ 1.5
52	5.2

Work with centimetres and decimetres provides an opportunity to use decimal notation and to reinforce the basic structure of the metric system. The relationship between centimetres and decimetres is examined from two points of view — place value and the part-of-a-whole concept. In the place-value approach, it is first established that one centimetre is one-tenth decimetre. Then, to express 17 cm, for example, in decimetres, 17 cm is 17 tenths dm, or 1 and 7 tenths dm, which is 1.7 dm.

dm	cm
1	17
	7

1.7 dm

Using the part-of-a-whole approach, 17 cm is the same as 1 dm and 7 of 10 equal parts of a decimetre, or 1 and 7 tenths dm, which is 1.7 dm.



Teaching Strategies

It is recommended that time be given first to a review of the concept of parts of a whole, with emphasis that the parts must be equal and that all parts together are the same as the whole. The new might begin with halves, thirds, and fourths, using concrete materials and semi-abstract aids that were prepared for similar work in Unit 2, but attention should be focussed very quickly on the concept of tenths and their fraction numerals. The decimal numerals 0.1, 0.2, 0.3, . . . , 0.9 can be introduced as an alternative way of writing $\frac{1}{10}$, $\frac{2}{10}$, $\frac{3}{10}$, . . . , $\frac{9}{10}$.

Each child will need her/his own set of models of ones and tenths. In fact, the children can be involved in the preparation of models which can then be placed in envelopes and kept in a convenient place for ready reference and daily use. Since the emphasis of this unit is on exploration of the decimal concept rather than facility with decimals, lesson activities have been developed around the use and continued support of concrete models of tenths and ones. A description for preparing these models is given below. The models are similar to the ones first illustrated on page 122. They have been developed to assist in the part-of-a-whole concept for tenths. For these models, the whole is always clearly seen as having 10 equal parts, and the decimal is clearly represented by the number of blue wholes and tenths.

Other materials can be used to reinforce the concept of tenths and decimals, for example, drinking straws. These can be cut into ten equal parts and some of the parts can be assembled to represent decimals such as 0.3, 0.8, and 1.5.

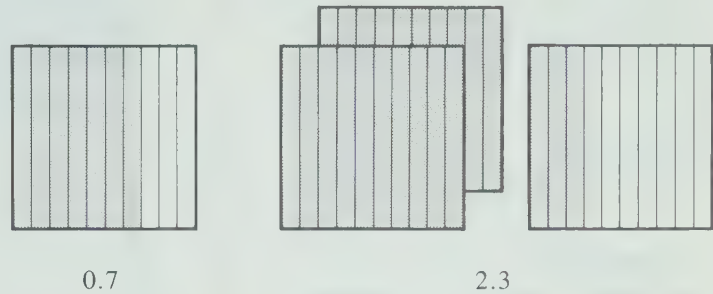
Children need an opportunity to compare the relative values of decimals. Strips of paper measuring 1 cm by 10 cm may be cut in copies of page T365. Children may color the appropriate number of squares on one side of each strip to show from 0.1 to 0.9. The corresponding decimal numeral can be written on the reverse side. By aligning two or more strips with the colored sides shown, children can see, for example, that 0.3 is less than 0.5 and that 0.9 is greater than 0.6. If all the strips are arranged side by side in order, the decimals can be related to matching points on the number line and the concept of order of decimals can be examined.

Once the decimal notation has been established, attention can be given to the use of concrete models to represent decimals and show the regrouping of 10 to 18 tenths as ones and tenths. Work with addition of decimals can follow naturally from the regrouping activities. Before beginning to work with addition it would be advisable to review the standard algorithm for addition, which was introduced in Unit 3. The addends may be limited to two digits.

Models for Ones and Tenths

To represent decimals make white models and blue models with copies of page T363.

To represent decimals less than one, cut a blue model into tenth strips and place the appropriate number of blue tenth strips on a white model. For example, to show seven-tenths, place seven blue tenth strips on a white model.



To represent decimals greater than one, show the required number of blue whole models and then place blue tenth strips on a white model. For example, to represent two and three-tenths, display two blue whole models and then place three blue tenth strips on a white model.

Being able to move the tenth strips allows the children to show regrouping and helps them to keep up with the pace of the lesson. Each child would benefit from having nine blue whole models, two white whole models, and eighteen blue tenth strips, for showing decimals from 0.1 to 9.9, and for regrouping up to eighteen tenths as one whole and some tenths.

A simpler method for representing decimals for game cards is to color the whole models blue and color the appropriate number of blue tenths on a white model.

Materials

models of ones and tenths as described above
objects to be measured in centimetres and decimetres
rulers marked with centimetres and decimetres

Vocabulary

decimals

decimal point

number line

LESSON OUTCOME

Write decimals to show tenths of a whole

Materials

models for ones and tenths prepared with copies of page T 363 as described on page T 133

Vocabulary

decimals, decimal point

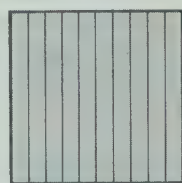
Background

This lesson introduces a method of representing less than a whole or a number less than one and presents the decimal as a shorter way to record tenths. A decimal and a corresponding fraction represent the same amount and have the same word name. In order to emphasize the meaning of the decimal and to provide a link with place value, decimals are read "two-tenths", not "decimal two" or "point two". The zero to the left of the decimal point to show zero ones for decimals less than one is introduced in the next lesson, and is used thereafter.

In the strictest sense the word "decimals" usually refers to the numerals for decimal fractions such as 0.7 and 3.4. For simplicity in this series, the word "decimals" is used when speaking of the rational numbers as well as the numerals.

7 DECIMALS

Using Decimals to Show Tenths



1 whole with 10 equal parts is written

1



1 part of a whole with 10 equal parts is written

$\frac{1}{10}$ or .1



one-tenth



5 parts of a whole with 10 equal parts is written

$\frac{5}{10}$ or .5



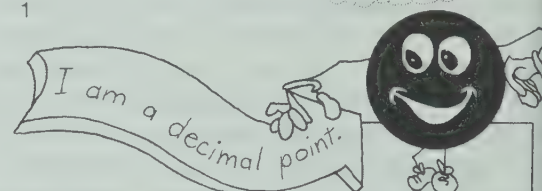
five-tenths

.1 and .5 are decimals.

The . is a decimal point.

A decimal names an amount less than 1 whole.

A decimal names the amount in tenths.



LESSON ACTIVITY

Before Using the Pages

- Discuss, and demonstrate if possible, uses of tenths as ten equal parts of a whole. A pizza might be cut into ten equal parts, or an area of ten tiles on the floor might be marked off by tape or chalk.
- Use models for ones and tenths to show one-tenth by placing the appropriate number of tenth strips on the ones' model. Review the word name and the fraction emphasizing that each is a different name for the same number.
Repeat this for two-tenths to nine-tenths and then for one whole.

Using the Pages

- Discuss the illustrations for *one*. Emphasize that the ten parts are blue and that the parts are equal. Point out that both diagrams show one whole.

Consider the illustrations for *one-tenth*. Ask for number of parts and the number of blue parts. Establish one-tenth is blue in both illustrations. Tell the children there is a shorter way to write "one-tenth". Have children compare the fraction and the decimal. Emphasize that both have the same meaning and the same word name — *one-tenth*.

Reinforce the concept of decimals by discussing number of blue parts for *five-tenths*. Compare the fraction, the decimal, and the word name.


- Draw the children's attention to the illustration of a decimal point. Ask the children what they think the decimal point does.

Working Together: Review that to show tenths a shape must be divided into ten equal parts.



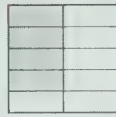
For Ex. 1-3, have the children count the parts and decide whether they are equal. Point out that the shapes are the same. For Ex. 4-6, point out that the shapes are different and that decimals can be used to describe any shape divided into ten equal parts.

Working Together

Which of these are divided into 10 equal parts?

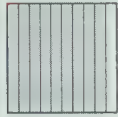








1. **no**  2. **yes**  3. **no** 

There are 10 equal parts in each shape.
Give the decimal that shows how much is shaded.

4. **.3**  5. **.6**  6. **.4** 

Exercises

For each picture that shows 10 equal parts,
write a decimal to show how much is shaded.

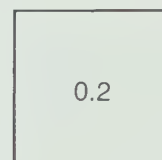
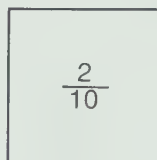
1. **.9**  2. **.1**  3. **.7** 
4.  5.  6. **.2** 
7.  8.  9. **.8** 

123

RELATED ACTIVITIES

- Have the children begin a display for uses of decimals. Newspaper clippings, weather charts, sports statistics, pictures of odometers and gasoline pumps, and children's illustrations are excellent examples. Daily additions to the display would encourage interest in it and keep it current for review.

- Have each child prepare a card to represent each decimal from one-tenth to nine-tenths in the way described on page T 133. Then have each child use the decimetre squares on page T 362 to prepare a card naming the fraction and a card naming the decimal from one-tenth to nine-tenths. These three types of cards may be used for games in Unit 8.



- For reinforcement the cards prepared in the above activity may be used for the game "Show Me". One child states, "Show me the decimal (fraction) (picture) for four-tenths." The other children hold up the card requested.



Use the display model described in the Overview to provide as many examples as necessary.

Exercises: Emphasize checking for ten equal parts first. For the exercises not showing ten equal parts, you may wish to have the children write "No". They may benefit from discussing the reason for each "No". (There are not ten parts or the ten parts are not equal.)

For reinforcement, have children read answers aloud.

Assessment

For each picture that shows ten equal parts, write a decimal to show how much is shaded.

2.  **.3**
4.  **.5**

LESSON OUTCOME

Read and write decimal notation from 0.0 to 9.9

Materials

models for 9 ones and 9 tenths as described on page T 133

Prerequisite Skills

Write a decimal for tenths less than one

Checking Prerequisite Skills

Write a decimal to show how much is shaded.



.3



.7

Background

In this lesson, the zero before the decimal point to show zero wholes is introduced as the way to write decimals. The decimal point separates and also links the ones and tenths.

Note that decimals are read and written “one and one-tenth” not “one decimal one” or “one point one”. Note also that a hyphen is used in the words of fraction and decimal names.

Using Decimals to Show Wholes and Tenths

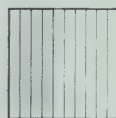


1 whole and
1 of 10 equal parts of
another whole is written

$1\frac{1}{10}$ or 1.1

one and one-tenth

Use the word *and* for
the decimal point.



0 wholes and
4 of 10 equal parts
is written

$\frac{4}{10}$ or 0.4

four-tenths

or

zero and four-tenths

A decimal shows how many wholes
and how many tenths of another whole.

Working Together

How many whole ones? How many tenths?
Give the decimal that shows how much is shaded.

1.



124
3 whole ones
6 tenths
3.6

2.



0 whole ones
5 tenths
0.5

LESSON ACTIVITY

Before Using the Pages

- Review decimals as parts of a whole. Use the models as described on page T 134. Have children write the corresponding decimals on the board.
- Review fractions greater than one. Use the models for ones and tenths to show a selection of fractions to nine and nine-tenths. Have children name the fraction shown, and write the numeral and the word name on the board. Remind the children about the hyphen and the word “and” in the word names. Vary the procedure by having children display models for fractions that you name.

Using the Pages

- Discuss the illustration for 1.1. Ask for the number of wholes and then for the number of tenths. Emphasize the location of the decimal point between the wholes and the tenths.

Tell the children that, as for decimals less than one, same word name refers to the fraction and the decimal.










- Discuss the illustration for 0.4. Ask for the number of wholes and then for the number of tenths. Ask the children how decimal is written differently from in the previous lesson. Emphasize that the decimals are written with the zero show zero wholes. Reinforce the position of the decimal point.
- Ask the children what they think a decimal shows. Have them compare their answers and the information on the page.

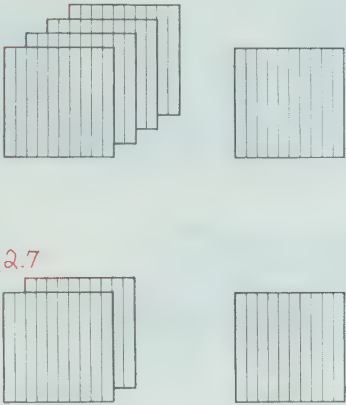
Working Together: The order of the exercises draws attention to the fact that the number of whole ones is considered first and then the number of tenths. Following these steps help the children to write the numerals in the correct order and remember the zero for zero wholes. These steps also help the children position the decimal point correctly.

Use the display model described in the Overview for many examples as necessary.

Exercises

Write a decimal to show how much is shaded.

1.  0.3 10. 4.2
2.  0.5
3.  0.2
4.  0.8
5.  0.6 11. 2.7
6.  0.7
7.  0.1
8.  0.9
9.  0.4



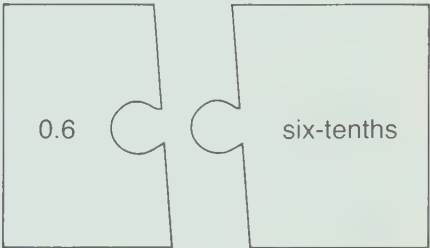
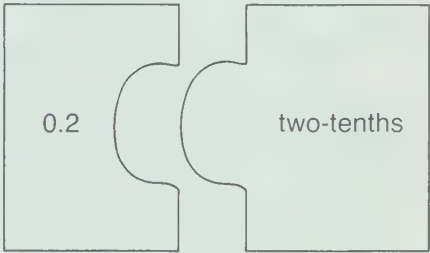
Copy and complete this table.

	Words	Fraction	Decimal
12.	two and seven-tenths	$2\frac{7}{10}$	2.7
13.	six and two-tenths	$6\frac{2}{10}$	6.2
14.	three and six-tenths	$3\frac{6}{10}$	3.6
15.	five-tenths	$\frac{5}{10}$	0.5
16.	five and three-tenths	$5\frac{3}{10}$	5.3
17.	one-tenth	$\frac{1}{10}$	0.1
18.	nine-tenths	$\frac{9}{10}$	0.9
19.	four and four-tenths	$4\frac{4}{10}$	4.4
20.	nine and eight-tenths	$9\frac{8}{10}$	9.8

125

RELATED ACTIVITIES


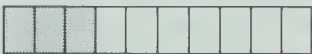

- Have the children add pictures and magazine or newspaper clippings showing decimals to the display.
- Children may like to color copies of page T363 to show decimals. These could be added to the display.
- For reinforcement, prepare a work sheet asking the children to draw lines to match a list of decimals and a list of word names.
- Adapt the game “Show Me” on page T135 for decimals with wholes and tenths.
- Children may enjoy playing the game “Concentration” on page T349, using two of the three types of cards prepared for page T135.
- Children may work alone or together to join puzzles similar to the following.



Exercises: For Ex. 1-11, make sure that the children understand that the numerals, not the word names, are required.
Discuss the ways four-tenths is shown on page 125. Ask for other ways of naming numbers. Discuss the three ways shown for Ex. 12 in the table.

Assessment

Write a decimal to show how much is shaded.

2.   0.3
-  1.7

Copy and complete this table.

Words	Fraction	Decimal
one and nine-tenths	$1\frac{9}{10}$	1.9
five and two-tenths	$5\frac{2}{10}$	5.2
six-tenths	$\frac{6}{10}$	0.6

OBJECTIVE

Demonstrate competence in using decimal notation from 0.0 to 9.9

RELATED ACTIVITIES

- Have the children draw pictures illustrating decimals for the decimal display.
- Children may enjoy drawing pictures of packages of pens to illustrate the decimals for Ex. 7-11.
- Children may play the game “Snap” described on page T349, using two of the three types of cards prepared for page T135.

Practice

There are 10 pens to a package.
Write a decimal to show how many packages.

7.

8.

1.

3.4 packages

2.

2.8 packages

3.

1.5 packages

4.

0.7 packages

Write a decimal to show how many drinking straws.

5.

0 2.6 drinking straws 1

6.

0 1.3 drinking straws 1

Use tracing paper on this drinking straw.



Draw

7. 2.4 drinking straws.

8. 3.7 drinking straws.
9. 1.6 drinking straws.

10. three and two-tenths drinking straws.
11. five-tenths of a drinking straw.

9.

10.

11.

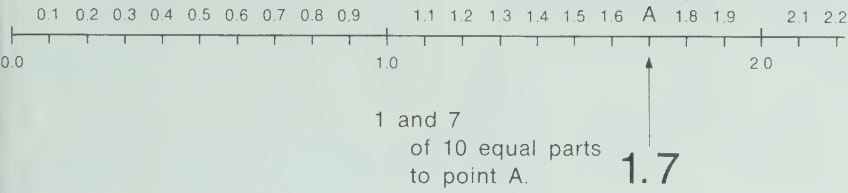
LESSON ACTIVITY

Using the Page

- Explore the relation between decimals and packages of pens. Emphasize that the packages show ten equal parts. Ask for the number of packages and then the number of tenths. Have the children write the decimal. Make sure that the children know the exercise asks for a decimal showing the number of packages, not the number of pens.
- Discuss the relation between decimals and straws. Have the children count the tenths across the straws before assigning the exercises. Lead the children to realize that the straws are divided into ten equal parts.

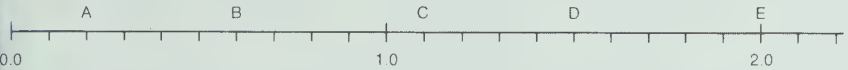
Decimals and Number Lines

Decimals name points on number lines.



Working Together

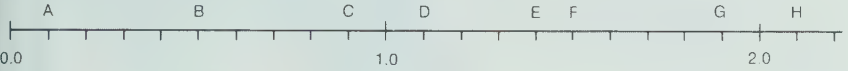
For this number line,



- 1. what point matches 0.6? B
- 2. what decimal names point D? 1.4

Exercises

For this number line,



- what point matches
- 1. 0.1? A
 - 2. 0.9? C
 - 3. 1.1? D
 - 4. one and five-tenths? F
- What is the decimal name for
- 5. point G? 1.3
 - 6. point E? 0.9
 - 7. point H? 1.5
 - 8. point B? 0.3

For this number line,



copy and complete the chart.

Point	?	I	?	E	?	O	?	K
Decimal	1.3	?	0.2	?	2.2	?	1.7	?

SSON ACTIVITY

ore Using the Page

For review, draw an unlabeled number line for the whole numbers from 0 to 10. Label the points 0 and 7. Then have children write the numerals for the remaining points on the number line.

Ask the children how tenths might be shown on the number line used in the first activity. Lead them to suggest that the line segments between the whole numbers must be divided into ten equal parts. Use a line marked in this way and have children read the decimals for several points and also locate the points that match several given decimals.

g the Page

Compare the number line at the top of the page with the one on the board. For the former, emphasize that 0.0 refers to the same point as 0, and that 1.0 refers to the same point as 1.

LESSON OUTCOME

Match decimals with points on a number line

Vocabulary

number line

Prerequisite Skills

Write decimals showing tenths

Checking Prerequisite Skills

Write a decimal to show how much is shaded.



RELATED ACTIVITIES

- Add a number line showing decimals to the display. Arrows connecting illustrations on the display board with corresponding points on the number line would reinforce the concept of the number line.
- Three or four children may enjoy a number-line game. Prepare a number line showing 0.0, 0.1, 0.2, . . . , 9.9; one die marked 0.0, 0.1, 0.2, 0.3, 0.4, 0.5; and a marker for each player. Each player throws the die and counts the corresponding number of places on the number line. The first player to reach 9.9 is the winner.

Point out that in terms of meaning and position on the number line 0.9 is close to 1 and 1.1 is also close to 1.

- Have the children count by tenths to seventeen-tenths on the number line. Then have them locate 1.7 by finding 1.0 and then counting seven tenths. Read the statements given.

Working Together: Have the children compare this number line with the one above it. Ask questions to emphasize the number of parts between whole numbers, the name given to each part, and the number of wholes and tenths from zero to any point, as well as the number of tenths beyond a whole number.

Exercises: Make sure the children understand which number line is associated with each exercise and how to complete the chart for Ex. 9.

Assessment

For this number line,

- 1. what matches 1.4? point E
- 2. what is the decimal name for point B? 0.2



LESSON OUTCOME

Compare and order decimals from 0.0 to 9.9

Prerequisite Skills

Compare and order whole numbers; match decimals with points on a number line

Checking Prerequisite Skills

Which is greater,

- 43 or 231?
- 303 or 330?

List the numbers in order, from least to greatest.

- 23, 320, 32, 302, 200, 203
23, 32, 200, 203, 302, 320

For this number line,



- what point matches 0.5? B
- what is the decimal name for point C? 0.5

LESSON ACTIVITY

Before Using the Pages

- As a warm-up, have the children locate whole numbers on a number line showing 0 to 25. Discuss that numbers increase as you move to the right on the number line and decrease as you move to the left.
Name two whole numbers for the children to locate on the number line and then have them note how the numbers are related by their positions on the number line.
Repeat for three whole numbers.

Using the Pages

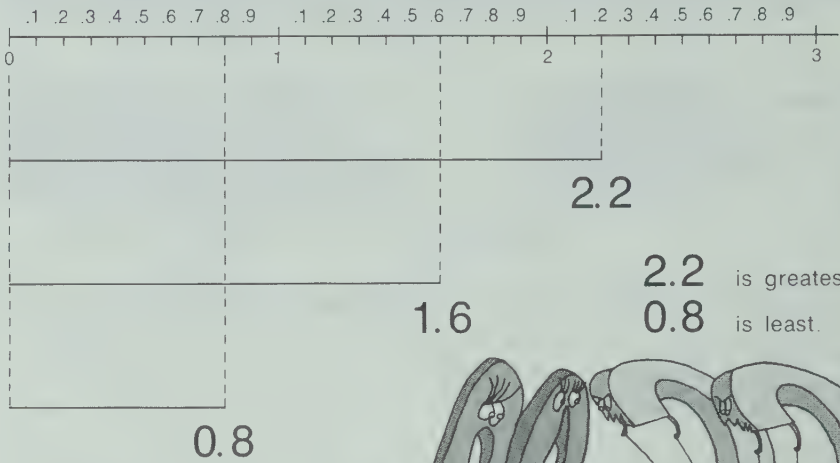
- Locate 0.8, 1.6, and 2.2 on the number line on page 128. Using the information and the questions, compare and order the three decimals. Compare the order of the decimals with their positions on the number line. Reinforce that the numbers increase as you move to the right. Review that numerals such as 1 and 1.0 name the same number.

Comparing and Ordering Decimals

A number line can be used to compare and order decimals.

Which of these numbers is greatest? Which is least?

0.8
2.2
1.6



Working Together

Which is greater,

- 0.2 or 0.4?
- 1.2 or 0.8?

Which is less,

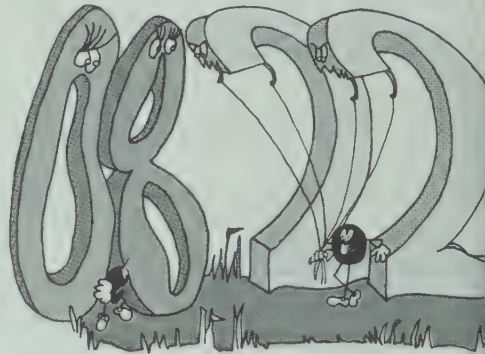
- 1.6 or 1.3?
- 1.9 or 2.1?

Show these numbers in order, from least to greatest.

- 0.3, 2.1, 1.2, 1.1, 2.2 0.3, 1.1, 1.2, 2.1, 2.2

Complete each pattern.

- 0.0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.7, 0.8, 0.9
- 0.8, 0.9, 1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7



Working Together: Have the children refer to the number line to check their answers and to provide greater understanding of comparing and ordering decimals. Emphasize comparing the ones and then the tenths.

Provide as many additional exercises as necessary. Include examples with different numbers of ones (1.2), with the same number of ones (2.2, 2.4), and reversed digits (1.2, 2.1).

Exercises: Have the children read the instructions carefully to determine whether they are to name the greater or the least number.

For reinforcement have the children say the word number for the answers, locate answers on a number line, and name the least and the greatest decimal for each of Ex. 13-15.

Keeping Sharp: These exercises prepare the children for the repeated addition approach to multiplication which begins in Unit 8. Make sure they understand the significance of the arrows. The pattern for each row of answers could be marked on a number line.

RELATED ACTIVITIES

- Have the children add more examples of decimals to the display board.
- Children may wish to illustrate decimals from the page.
- A work sheet for more practice could show pairs of decimals for which the children color the greater (lesser) decimal.
- To adapt the game on page T 35 for ones and tenths, prepare pocket charts similar to the following.

high		
	o	t
middle		
	o	t
low		
	o	t

- You may wish to provide a number line for each child to follow instructions such as, "Locate 4.3" and "Ring the greater of 2.3 and 3.2".
- For reinforcement provide envelopes containing five numeral cards showing decimals for children to order from least to greatest.
- The cards prepared for page T 135 could be used for the game "Show Me". A child points to a number line and states, "Show me the decimal (illustration) for this point." The other children show the appropriate cards.
- Children may play the game "Match Up" described on page T 349, using the three types of cards prepared for page T 135.

Exercises

Which is greater,

1. 0.3 or 0.5?
2. 0.6 or 0.4?
3. 8.1 or 7.9?
4. 2.0 or 1.9?
5. four and two-tenths or three and nine-tenths?
6. five-tenths or one and four-tenths?

Which is less,

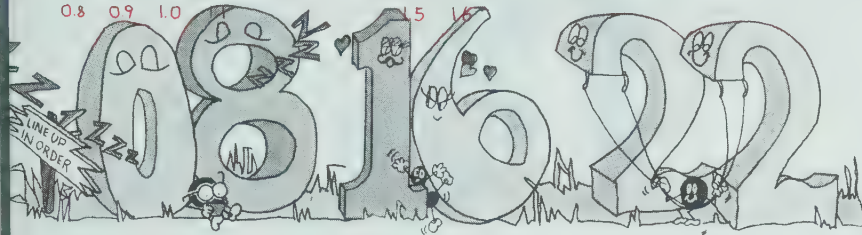
7. 1.0 or 0.9?
8. 3.9 or 4.1?
9. 0.4 or 4.0?
10. 2.1 or 1.8?
11. two and nine-tenths or three and two-tenths?
12. one and six-tenths or two?

List these numbers in order, from least to greatest.

13. 1.9, 2.0, 1.8, 2.3, 1.5
1.5, 1.8, 1.9, 2.0, 2.3
14. 2.2, 4.0, 3.4, 4.3, 0.4
0.4, 2.2, 3.4, 4.0, 4.3

Complete each pattern.

15. 1.6, 1.7, 1.8, 1.9, 2.0, 2.1, 2.2, 2.3, 2.4, 2.5
16. 0.8, 0.9, 1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7



Complete each addition chain.

1.
$$\begin{array}{r} 0 \\ +3 \\ \hline 3 \end{array} \rightarrow \begin{array}{r} 3 \\ +3 \\ \hline 6 \end{array} \rightarrow \begin{array}{r} 6 \\ +3 \\ \hline 9 \end{array} \rightarrow \begin{array}{r} 9 \\ +3 \\ \hline 12 \end{array} \rightarrow \begin{array}{r} 12 \\ +3 \\ \hline 15 \end{array} \rightarrow \begin{array}{r} 15 \\ +3 \\ \hline 18 \end{array}$$
2.
$$\begin{array}{r} 0 \\ +4 \\ \hline 4 \end{array} \rightarrow \begin{array}{r} 4 \\ +4 \\ \hline 8 \end{array} \rightarrow \begin{array}{r} 8 \\ +4 \\ \hline 12 \end{array} \rightarrow \begin{array}{r} 12 \\ +4 \\ \hline 16 \end{array} \rightarrow \begin{array}{r} 16 \\ +4 \\ \hline 20 \end{array}$$
3.
$$\begin{array}{r} 0 \\ +5 \\ \hline 5 \end{array} \rightarrow \begin{array}{r} 5 \\ +5 \\ \hline 10 \end{array} \rightarrow \begin{array}{r} 10 \\ +5 \\ \hline 15 \end{array} \rightarrow \begin{array}{r} 15 \\ +5 \\ \hline 20 \end{array} \rightarrow \begin{array}{r} 20 \\ +5 \\ \hline 25 \end{array}$$

KEEPING SHARP

129

Assessment

Which is greater,

1. 4 or 4.6?
2. 8.0 or 0.8?

Which is less,

3. 1 or 1.3?
4. 9.9 or 9.0?

List these numbers in order, from least to greatest.

5. 5, 5.4, 4.0, 5.0, 0.4, 0.5, 1.1
0.4, 0.5, 1.1, 4.0, 4.5, 5.0, 5.4

Complete this pattern.

6. 3.0, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6

LESSON OUTCOME

Understand place value for ones and tenths; regroup with decimals; solve related word problems

Materials

models for 9 ones and 9 tenths as described on page T 133 for each child

Prerequisite Skills

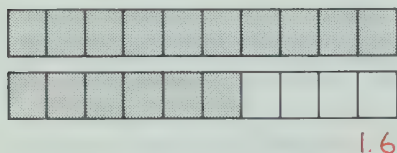
Regroup ones and tens; relate decimals to models

Checking Prerequisite Skills

Complete.

1. $23 = \underline{2}$ tens $\underline{3}$ ones

2. Write the decimal to show how much is shaded.



Background

Relating place value and decimals extends the base-ten system to parts of a whole. Regrouping tenths and ones requires the same process as regrouping ones and tens. Understanding decimals in terms of ones and tenths and in terms of tenths is the basis for understanding and computing with decimals.

LESSON ACTIVITY

Before Using the Pages

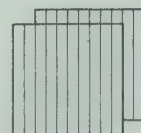
- To explore place value for ones and tenths, write 3.5 on the board. Have the children use their models to represent the number. Ask for the number of ones and the number of tenths. Record these on a place-value chart for ones and tenths. Repeat this with a few examples.
- To explore regrouping tenths as ones, write 42 tenths in the tenths' place of a place-value chart. Have the children represent the number with the models by counting 10 tenths on each of four whole models and 2 tenths on another model. Then ask the children for the number of ones first and then the number of tenths. Record the regrouping on the chart. Emphasize that 4 ones and 2 tenths names the same number as 42 tenths. Repeat with similar examples.
- To explore regrouping ones as tenths, write 7 in the ones' place and 3 in the tenths' place of a place-value chart. Have the children represent the number with their models. Then

Decimals and Place Value

This picture shows

ones	tenths
2	8

two and eight-tenths
or
2.8



The picture also shows

ones	tenths
	28

28 tenths



This picture shows

ones	tenths
1	6

16 tenths



The picture also shows

ones	tenths
1	6

one and six-tenths
or
1.6

The decimal point always goes between the ones place and the tenths place.

Working Together

Show each of these as a decimal.

1.

ones	tenths
3	6

 3.6
2.

ones	tenths
	25

 2.5

Copy and complete the place-value chart for each of these.

3. 2.7
4. three
5. 68 tenths

ones	tenths
? 2	? 7
? 3	? 0
? 6	? 8

ask for the number of tenths in all. Record the number of tenths on the place-value chart. Emphasize that 73 tenths names the same number as 7 ones and 3 tenths. Repeat with similar examples.

Using the Pages

- Discuss the different ways of showing 2.8. Have the children count the 2 ones and the 8 tenths. Then review that a whole number has 10 tenths and, therefore, that 2 whole numbers have 20 tenths. Have the children count the tenths as follows: 10, 20, 21, 22, . . . , 27, 28 tenths. Compare the illustration with the decimal and the word name. Emphasize that the decimal point separates the ones and the tenths and also joins the ones and the tenths as one numeral. Repeat this for 1.6. Focus on the illustration and emphasize the position of the decimal point.

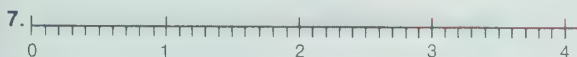
Working Together: Have the children use their models when required.

Exercises

Write the missing entry for each row of this table.

	ones	tenths	Words	Decimal
1.	2	5	two and five-tenths	2.5
2.	5	8	five and eight-tenths	5.8
3.		2	two-tenths	? 0.2
4.		45	four and five-tenths	? 4.5
5.		32	three and ? two-tenths	3.2
6.	? 8	? 0	eight	8.0

Complete a place-value chart for each amount shown on these number lines.



Each pizza was cut into 10 pieces.
Each piece was one-tenth of a pizza.
Answer each question with a decimal.



10. 37 pieces of pizza were sold.
How many pizzas were sold? **3.7**

11. 13 pieces were not sold.
How many pizzas were not sold? **1.3**

- *13. Shelly bought 7 pieces, Wilma bought 6, and Charlie bought 9.
How many pizzas did they buy in all? **2.2**

- *12. How many pizzas were there in all? **5.0**

Add.

$$\begin{array}{r} 1. \quad 61 \\ + 32 \\ \hline 93 \end{array}$$

$$\begin{array}{r} 3. \quad 439 \\ + 57 \\ \hline 496 \end{array}$$

$$\begin{array}{r} 5. \quad 76 \\ + 31 \\ \hline 107 \end{array}$$

$$\begin{array}{r} 7. \quad 54 \\ + 88 \\ \hline 142 \end{array}$$

$$\begin{array}{r} 9. \quad 276 \\ + 225 \\ \hline 501 \end{array}$$

$$\begin{array}{r} 11. \quad 347 \\ + 157 \\ \hline 504 \end{array}$$

$$\begin{array}{r} 2. \quad 115 \\ + 460 \\ \hline 575 \end{array}$$

$$\begin{array}{r} 4. \quad 326 \\ + 349 \\ \hline 675 \end{array}$$

$$\begin{array}{r} 6. \quad 250 \\ + 67 \\ \hline 317 \end{array}$$

$$\begin{array}{r} 8. \quad 472 \\ + 58 \\ \hline 530 \end{array}$$

$$\begin{array}{r} 10. \quad 486 \\ + 257 \\ \hline 743 \end{array}$$

$$\begin{array}{r} 12. \quad 426 \\ + 374 \\ \hline 800 \end{array}$$

Subtract.

$$\begin{array}{r} 13. \quad 86 \\ - 50 \\ \hline 36 \end{array}$$

$$\begin{array}{r} 15. \quad 71 \\ - 17 \\ \hline 54 \end{array}$$

$$\begin{array}{r} 17. \quad 148 \\ - 61 \\ \hline 87 \end{array}$$

$$\begin{array}{r} 19. \quad 320 \\ - 23 \\ \hline 297 \end{array}$$

$$\begin{array}{r} 21. \quad 402 \\ - 26 \\ \hline 376 \end{array}$$

$$\begin{array}{r} 22. \quad 600 \\ - 388 \\ \hline 212 \end{array}$$

KEEPING SHARP

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RELATED ACTIVITIES

- Have the children use copies of page T 363 to cut and paste models of ones and tenths to show two forms of a decimal such as 2.5; that is, as 2 ones and 5 tenths, and as 25 tenths. This chart can be placed in the decimal display.

- For reinforcement, prepare a work sheet telling the children to match decimals shown in the three ways on the chart in the previous activity.

- Cards similar to the following could be used for the game "Concentration" described on page T 349.

3 ones and 4 tenths

34 tenths

For Ex. 1 and 2, have them decide whether regrouping is necessary before they write the decimal. Provide more examples that require regrouping. For Ex. 3-5, have the children find an answer to replace each question mark. Provide more exercises similar to each of Ex. 3-5.

Exercises: For Ex. 1-6, emphasize that the chart contains three ways of showing a decimal. Have the children replace the question marks to complete the chart. Discuss the absence of question marks in the ones' place for Ex. 4 and 5. For Ex. 7-9, remind the children to regroup as though preparing to write the decimal.

The word problems show a need for regrouping decimals. For Ex. 10-13, remind the children to write the numerals, not the word names, for the decimals. Have the children show their work and answer each question in a sentence. Ex. 12 requires going beyond the problem itself for information. Children may need help with Ex. 12 and 13.

Keeping Sharp: You may wish to review addition and subtraction facts and algorithms, especially regrouping procedures.

Assessment

Write the decimal.

1. four-tenths **0.4** 2. 9 ones and 9 tenths **9.9**
3. 0 ones and 6 tenths **0.6** 4. 18 tenths **1.8**

Complete.

5. 4.3 = **43** tenths
6. 0.8 = **8** tenths

LESSON OUTCOME

Add decimals with regrouping, sums to 9.9

Materials

models for 1 one and 18 tenths as described on page T 133 for each child

Prerequisite Skills

Regroup decimals (ones and tenths); add two-digit numbers with regrouping

Checking Prerequisite Skills

Complete.

1. 44 tenths = $\frac{4}{4}$ ones and $\frac{4}{4}$ tenths

Write the decimal.

2. 3 ones and 9 tenths **3.9**

4. 88 tenths **8.8** 3. 55 tenths **5.5**

Add. 5. 1 tenth **0.1**

6. $\begin{array}{r} 18 \\ + 26 \\ \hline 44 \end{array}$

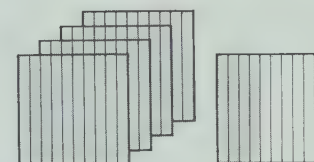
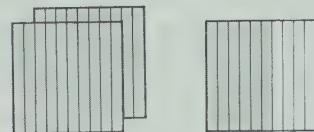
7. $35 + 61$ **96**

Background

Learning the place-value aspect of decimals in the previous lesson shortens the traditional presentation of the algorithm for adding decimals. The method in this lesson presents addition as an extension of regrouping. It replaces expressing decimals as fractions with denominators of ten to explain the algorithm.

Adding Decimals

Add 1.8 and 2.6.

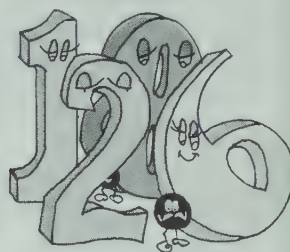


The sum of 1.8 and 2.6 is 4.4.

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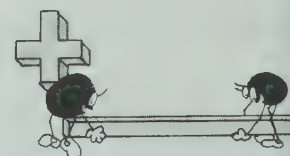
$$\begin{array}{r} \text{ones} \quad \text{tenths} \\ 1.8 \\ + 2.6 \\ \hline \end{array}$$

Show 1.8 and 2.6 with their ones and tenths lined up in vertical form.



$$\begin{array}{r} 1.8 \\ + 2.6 \\ \hline 4.4 \end{array}$$

Add the tenths.

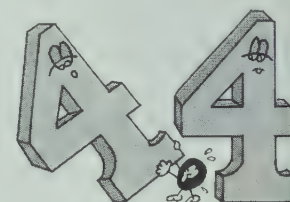


Regroup 14 tenths as 1 one and 4 tenths. Show the 1 one lined up with the other ones.

$$\begin{array}{r} 1 \\ 1.8 \\ + 2.6 \\ \hline 4.4 \end{array}$$

$$\begin{array}{r} 1 \\ 1.8 \\ + 2.6 \\ \hline 4.4 \end{array}$$

Add the ones and place the decimal point.



LESSON ACTIVITY

Before Using the Pages

- Explore addition of decimals less than one without regrouping. Write addends having a sum less than one on a chart for ones and tenths. Have the children use their models to show the addition. Write the sum in the tenths' column. Repeat a few times.
- Explore addition of decimals less than one having a sum greater than one. Write the addends in the tenths' column of the chart. Have the children show the addition with their models. Write the sum for the number of tenths in the tenths' column. Have the children regroup their models to show ones and tenths. Then have a child write the sum as a decimal. Repeat a few times.

Using the Pages

- For the worked example, have the children associate illustrations of models, the blue on the numerals, and statements for each step in the example. Emphasize position of the decimal point between the ones and tenths. Point out that the dotted one indicates 10 tenths are thought of in the tenths' place and then regrouped as one. Review the location of the regrouped 1 one.

Working Together: For Ex. 1-3, ask the children why the ones and tenths should be lined up in vertical form. Lead them to realize that the vertical form makes it easier to add and regroup. Ex. 5 provides an example of adding the tenths first to allow regrouping 10 tenths as 1 one before adding the ones. For Ex. 6 and 7, have the children write addends in vertical form.

Working Together

Line up the ones and tenths in vertical form.

1. $3.5 + 4.6$ $\begin{array}{r} 3.5 \\ +4.6 \\ \hline \end{array}$ 2. $2.7 + 5.0$ $\begin{array}{r} 2.7 \\ +5.0 \\ \hline \end{array}$ 3. $0.8 + 4.2$ $\begin{array}{r} 0.8 \\ +4.2 \\ \hline \end{array}$

Follow the steps.

4. $\begin{array}{r} 6.0 \\ +2.3 \\ \hline 8.3 \end{array}$ 5. $\begin{array}{r} 5.6 \\ +2.8 \\ \hline 8.4 \end{array}$
- Add tenths. \uparrow Add tenths and regroup. \uparrow
Add ones. \uparrow Add ones. \uparrow

Add.

6. $2.6 + 3.3$ 5.9 7. $4.3 + 2.7$ 7.0 8. $\begin{array}{r} 8.0 \\ +0.8 \\ \hline 8.8 \end{array}$ 9. $\begin{array}{r} 0.4 \\ +7.9 \\ \hline 8.3 \end{array}$

Exercises

Use the sums in the box to help you write these sums.

1. $\begin{array}{r} 9.1 \\ +0.7 \\ \hline 9.8 \end{array}$ 2. $\begin{array}{r} 3.9 \\ +2.3 \\ \hline 6.2 \end{array}$ 3. $\begin{array}{r} 2.0 \\ +1.5 \\ \hline 3.5 \end{array}$
4. $\begin{array}{r} 3.7 \\ +0.6 \\ \hline 4.3 \end{array}$ 5. $\begin{array}{r} 1.6 \\ +1.4 \\ \hline 3.0 \end{array}$ 6. $\begin{array}{r} 5.4 \\ +1.0 \\ \hline 6.4 \end{array}$
7. $\begin{array}{r} 4.3 \\ +3.7 \\ \hline 8.0 \end{array}$ 8. $\begin{array}{r} 6.1 \\ +2.5 \\ \hline 8.6 \end{array}$ 9. $\begin{array}{r} 5.9 \\ +3.6 \\ \hline 9.5 \end{array}$

Add.

10. $1.4 + 3.3$ 4.7 11. $2.1 + 6.4$ 8.5 12. $2.3 + 2.9$ 5.2 13. $3.7 + 5.8$ 9.5
14. $1.1 + 0.9$ 2.0 15. $0.6 + 2.0$ 2.6 16. $4.3 + 4.3$ 8.6 17. $3.5 + 3.8$ 7.3
18. $\begin{array}{r} 0.7 \\ +6.1 \\ \hline 6.8 \end{array}$ 19. $\begin{array}{r} 6.9 \\ +1.7 \\ \hline 8.6 \end{array}$ 20. $\begin{array}{r} 2.5 \\ +4.0 \\ \hline 6.5 \end{array}$ 21. $\begin{array}{r} 4.7 \\ +1.7 \\ \hline 6.4 \end{array}$ 22. $\begin{array}{r} 2.7 \\ +0.3 \\ \hline 3.0 \end{array}$
23. $\begin{array}{r} 5.8 \\ +3.5 \\ \hline 9.3 \end{array}$ 24. $\begin{array}{r} 1.2 \\ +6.5 \\ \hline 7.7 \end{array}$ 25. $\begin{array}{r} 4.7 \\ +4.9 \\ \hline 9.6 \end{array}$ 26. $\begin{array}{r} 9.3 \\ +0.2 \\ \hline 9.5 \end{array}$ 27. $\begin{array}{r} 4.7 \\ +2.7 \\ \hline 7.4 \\ 133 \end{array}$

Exercises: Have the children read the instructions and compare Ex. 1-9 with the completed additions of whole numbers. For Ex. 10-17, emphasize lining up the addends. Remind the children to write the decimal point between the ones and the tenths in the answer.

Assessment

1. $\begin{array}{r} 7.3 \\ +2.0 \\ \hline 9.3 \end{array}$ 2. $\begin{array}{r} 6.3 \\ +1.7 \\ \hline 8.0 \end{array}$
3. $4 + 2.7$ 7.1 4. $5.5 + 3.9$ 9.4

RELATED ACTIVITIES

- The children may be able to find examples of adding decimals for the decimal display board.
- For reinforcement, children could add decimals across and down in addition squares similar to the following. The lower right square provides a check.

+	→	
↓		
3.2	4.9	
6.7	1.1	

- This game reviews addition and comparison of decimals. Prepare a work sheet with the following chart for each child. Make a numeral card for each digit from 0 to 5. Draw four of the numeral cards. Read each number in turn for the children to write in one of the four squares above the double line. Then have the children add the decimals. The child (or children) with the greatest sum scores a point.

+	

- Adapt the game "Total Action" on page T 349. Prepare cards as follows: five each for 0.0 to 0.4, four each for 0.5 to 0.7, three each for 0.8 to 1.0. Groups of cards with the sum of 1.0 form a set. (0.0 can be added to any set and 1.0 forms a set itself.)

LESSON OUTCOME

Express decimetres as centimetres and centimetres as decimetres using decimals

Materials

rulers marked with centimetres and decimetres; objects to measure in centimetres and decimetres

Prerequisite Skills

Relate centimetres and decimetres; regroup with decimals

Checking Prerequisite Skills

Write as a decimal.

1. 16 tenths 1.6 2. 2 tenths 0.2

Complete.

3. $5.2 = \underline{52}$ tenths

4. $0.9 = \underline{9}$ tenths

5. 1 dm = 10 cm

6. 40 cm = 4 dm

Background

Expressing centimetres as decimetres and decimetres as centimetres can be approached in terms of place value or in terms of part of a whole. The place-value method uses decimals and regrouping. For example, 15 cm equals 15-tenths dm or 1 and 5-tenths dm or 1.5 dm. The part-of-a-whole method considers 15 cm as 1 dm and 5 of 10 equal parts of a whole decimetre or 1.5 dm.

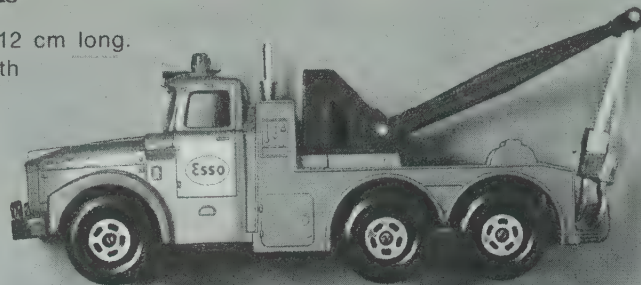
LESSON ACTIVITY

Before Using the Pages

- Have the children measure some objects in centimetres and others in decimetres to review these units of measurement.
- Have the children use a ruler to measure an object in centimetres only and record the measurement on the board in a chart similar to the one for Ex. 1-3 of *Working Together*. Then have them use the ruler to measure the length in decimetres and centimetres. Record this on the chart. Then have them measure the length in terms of whole decimetres and tenths of a decimetre. Record this on the chart using decimals. Repeat this procedure for a few examples.
- Have the children use a ruler to measure an object in decimetres and tenths of decimetres. Record the measurement using decimals, whenever necessary, on a chart similar to the one for Ex. 4 and 5 of *Working Together*. Have them use the ruler to measure the length in decimetres

Decimetres, Centimetres, and Decimals

The wrecker is 12 cm long.
What is its length in decimetres?



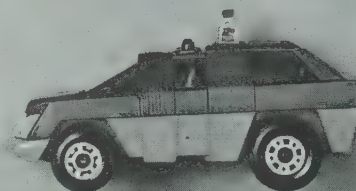
12 cm equals
1 dm and 2 cm.

Each centimetre
is one-tenth
of a decimetre.

12 cm is 12-tenths dm or 1 and 2-tenths dm.
12 cm = 1.2 dm

The wrecker is 1.2 dm long.

The car is 0.7 dm long.
What is its length in centimetres?



0.7 dm is
7 of 10 equal parts
of a decimetre.

7 of 10 equal parts
of a decimetre
is 7 cm.

0.7 dm = 7 cm

The car is 7 cm long.

134

and centimetres. Record this on the chart. Then have them measure the length in centimetres only. Record this on the chart. Repeat this procedure for a few examples.

- Use a ruler to develop the relation 1 dm = 10 cm
1 cm = 0.1 dm. Have the children use their rulers as they express a number of centimetres in terms of decimetres and vice versa; for example, 34 cm = 3.4 dm
1.6 dm = 16 cm.

Using the Pages

- The first worked example explores the relation between decimetres and centimetres using the example of expressing centimetres as decimetres. Approach the relation in terms of place value and as part of a whole.

Place-value approach: 1 cm is 1-tenth dm; 12 cm is 12-tenths dm which can be regrouped as 1 and 2-tenths dm or 1.2 dm.

Part-of-a-whole approach: 12 cm is 1 dm and 2 cm which is the same as 1 and 2-tenths dm or 1.2 dm.

Working Together

Complete the tables.

1.	14 cm	1 dm and 4 cm	1.4 dm
2.	27 cm	?2dm and ?7cm	2.7 dm
3.	5 cm	?0dm and ?5cm	0.5? dm
4.	2.6 dm	?2dm and ?6cm	2.6? cm
5.	0.3 dm	?0dm and ?3cm	3? cm

Give each length in decimetres.

- 0.8 dm
6. 8 cm
- 1.6 dm
7. 16 cm

Give each length in centimetres.

- 6 cm
8. 0.6 dm
- 20 cm
9. 2.0 dm

Exercises

Write each of these measurements in decimetres. Use a ruler to help you.

1. 23 cm
2. 18 cm
3. 10 cm
4. 2.3 dm
5. 1.8 dm
6. 1.0 dm or 1 dm
- 3 cm
- 80 cm
- 1 cm
- 0.3 dm
- 8.0 dm or 8 dm
- 0.1 dm

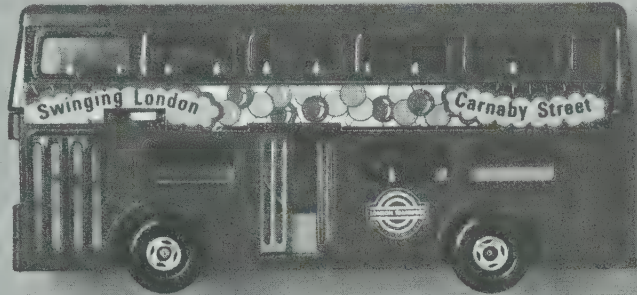
Write each of these measurements in centimetres. Use a ruler to help you.

7. 2 dm and 5 cm
8. 2.5 cm
9. 5.0 dm
10. 0.8 dm
- 3.2 dm
- 50 cm
- 8 cm
11. 1.0 dm
12. 0.1 dm
13. 1.1 dm
- 10 cm
- 1 cm
- 11 cm

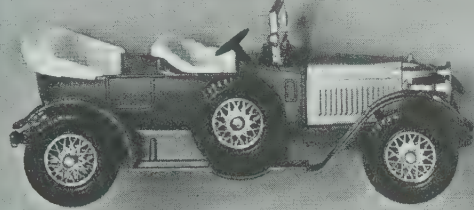
RELATED ACTIVITIES

- For the display, have the children paste or draw a picture and record its length in centimetres and in decimetres underneath the picture.
- For reinforcement, prepare a work sheet that names pairs of equal lengths (7.1 dm, 71 cm) and pairs of unequal lengths (6.0 dm, 6 cm). Instruct the children to ring the pairs that show equal lengths.
- Cut pictures of objects and paste each picture on a card. Write the length of each object on the back of the card to show the number of centimetres and also the decimal to show the number of decimetres. Children may use these as self-checking cards.
- Three or four children may enjoy playing a game involving centimetres and decimetres. Prepare a die showing 0.0 dm, 0.4 dm, 0.9 dm, 1.2 dm, 1.6 dm, and 2.0 dm. Prepare a game board showing a path marked in centimetres from 0 cm to 99 cm and provide a marker for each child. Each player throws the die and expresses the distance as centimetres. Then he/she counts the indicated distance in centimetres on the board. The first to reach 99 cm wins.

The bus is 1.2 dm long.



The car is 9 cm long.



A box is 22 cm long. Is it long enough to hold the bus and car placed end to end? yes

PROBLEM SOLVING

135

Expand the understanding of the relation between centimetres and decimetres using the example of expressing decimetres as centimetres. Approach this relation in terms of place value and also in terms of part of a whole. Emphasize that 1 cm is less than 1 dm and that 1 cm is 0.1 dm.

Place-value approach: 0.7 dm is 7-tenths dm or 7 cm.

Part-of-a-whole approach: 0.7 dm is 7 of 10 equal parts of a decimetre or 7 cm.

Working Together: Have the children relate each exercise to their centimetre rulers.

For Ex. 1-3, point out that since decimetres are longer than centimetres, there are fewer decimetres. For Ex. 4 and 5, point out that since centimetres are shorter than decimetres, there are more centimetres. Provide similar exercises. Include exercises with zero centimetres and with zero decimetres; for example, 0 cm = ___ dm and 0.3 dm = ___ cm. For Ex. 6-9, have the children follow the steps of Ex. 1-5 orally to find the answer.

Exercises: Have the children read the instructions to determine whether the exercises require expressing decimetres as centimetres or expressing centimetres as decimetres.

Problem Solving: Have the children check the lengths of the bus and the car. Tell them this is another problem with more than one step. Give them sufficient time to decide on the answer and the reason for it. Then have them show the answer by measuring the lengths and comparing them.

Assessment

- Write each of these measurements in decimetres.
1. 24 cm
2. 8 cm
- 2.4 dm
- 0.8 dm

3. 4.2 dm

4. 0.3 dm

42 cm

3 cm

OBJECTIVE

Demonstrate an understanding of the concepts and skills presented in this unit

RELATED ACTIVITIES

- Children could work in groups with one child stating a decimal and the other children each representing it in a different way (locating it on a number line, covering a diagram with strips, writing the decimal, writing the fraction).
- Cards similar to the following could be used for the game “Dominoes” on page T 349.

43 tenths	2 ones and 1 tenth
21 tenths	5 ones and 0 tenths

- Cards similar to the following could be used for the game “Concentration” on page T 349.

2.5 dm
25 cm

Checking Up

Write yes if the number and picture match.
Write no if they do not match.

1. no



0.6

2. yes



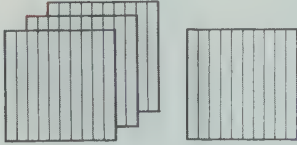
3. no



0.1

Write a decimal for each of these.

4. 3.2



5. 2.5



6. six and two-tenths 6.2

7. seven-tenths 0.7

8.

ones	tenths
2	3

 2.3

9. 45 tenths 4.5

For this number line,



10. what point matches 1.8? F 11. what decimal names point C? 0.7

Which is greater,

12. 0.2 or 0.5?

13. 5.2 or 3.9?

Which is less,

14. 2.3 or 0.8?

15. seven-tenths or one and one-tenth?

List these numbers in order, from least to greatest.

16. 1.6, 2.8, 0.8, 1.3, 0.6, 2.1 0.6, 0.8, 1.3, 1.6, 2.1, 2.8

Add.

17.
$$\begin{array}{r} 2.4 \\ + 1.5 \\ \hline 3.9 \end{array}$$

18.
$$\begin{array}{r} 1.8 \\ + 0.7 \\ \hline 2.5 \end{array}$$

19. $0.5 + 3.2$ 3.7

20. $1.9 + 2.6$ 4.5

Skills	Exercises	Related Pages
Understand the concept of tenths	1-3	T 134-T 135
Write decimals for diagrams	4, 5	T 136-T 137
Write decimals for words	6, 7	T 136-T 137
Understand place value for decimals	8, 9	T 142-T 143
Locate decimals on a number line	10, 11	T 139
Compare decimals	12-15	T 140-T 141
Order decimals	16	T 140-T 141
Add decimals	17-20	T 144-T 145

Comments

If the children answer yes for Ex. 1, review that the parts must be equal and for tenths there must be ten equal parts. Since Ex. 3 shows equal parts, some children may think the correct answer is yes. In this case, emphasize that for tenths there must be ten equal parts. Concrete materials as well as diagrams from page T 363 should be used to develop the concept of tenths as ten equal parts.

If the children have difficulty with Ex. 8 and 9, review the place value of decimals. Children who write 0.45 for Ex. 9 require more practice using materials and illustrations for regrouping tenths as ones.

Children who have difficulty with Ex. 10 and 11 may benefit from more work with the number line and decimals. Emphasize the positions of the whole numbers and then the positions of the numbers between the whole numbers.

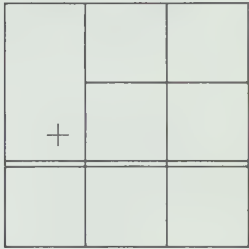
Ex. 19 and 20 may be difficult for children who forget to line up the addends in vertical form or for children who are uncertain about how to line up the addends. Practice in changing addition exercises from the horizontal form to the vertical form would be beneficial.

OBJECTIVE

Demonstrate competence in addition and subtraction skills

RELATED ACTIVITIES

- Use an appropriate activity from Units 1 and 3 for review. Children may be grouped according to the area in which they need practice.
- Some children may be challenged by exploring Ex. 29-33 further with models and number lines using several examples.
- Adapt the game involving adding for the greatest sum on page T 145. Use numeral cards for 0 to 9, change the chart as shown in the diagram below, and draw four cards each time.



- The game described above could be adapted for subtracting to find the least difference.

Add.			Subtract.		
1. 23 + 15 <u>38</u>	2. 30 + 42 <u>72</u>	3. 116 + 141 <u>257</u>	15. 57 - 52 <u>5</u>	16. 146 - 23 <u>123</u>	17. 130 - 110 <u>20</u>
4. 48 + 25 <u>73</u>	5. 106 + 39 <u>145</u>	6. 114 + 237 <u>351</u>	18. 92 - 45 <u>47</u>	19. 352 - 146 <u>206</u>	20. 370 - 342 <u>28</u>
7. 67 + 51 <u>118</u>	8. 395 + 52 <u>447</u>	9. 275 + 274 <u>549</u>	21. 608 - 336 <u>272</u>	22. 539 - 367 <u>172</u>	23. 725 - 342 <u>383</u>
10. 89 + 41 <u>130</u>	11. 252 + 369 <u>621</u>	12. 507 + 195 <u>702</u>	24. 311 - 263 <u>48</u>	25. 907 - 448 <u>459</u>	26. 541 - 197 <u>344</u>
13. \$6.45 + 0.65 <u>\$7.10</u>	14. \$3.79 + 1.69 <u>\$5.48</u>	27. \$8.00 - 3.57 <u>\$4.43</u>	28. \$3.03 - 1.78 <u>\$1.25</u>		

Copy and complete the chart.

	Two numbers	Their sum	Their difference	The greater number added to itself	The sum added to the difference
29.	34, 23	57	11	Add 34 and 34. 68	Add 57 and 11. 68
30.	42, 18	? 60	? 24	? 84	? 84
31.	185, 67	? 252	? 118	? 370	? 370
32.	454, 259	? 713	? 195	? 908	? 908
33.	Answers will vary.	?	?	?	?

Choose any two numbers.

These results should match. If they do not match, there is a mistake in your work.

KEEPING SHARP

LESSON ACTIVITY

Before Using the Page

- Use an oral drill to review addition and subtraction facts.
- Review addition and subtraction skills. Emphasize place value and regrouping.
- Review adding and subtracting with amounts of money.

Using the Page

For Ex. 1-28, remind the children to watch the signs. Complete Ex. 29 together and make sure the children understand the instructions. They may wish to try several pairs of numbers for Ex. 33, including some with identical addends, and compare the results afterward.

OBJECTIVE

Demonstrate competence in addition and subtraction skills; solve related word problems

Checking Skills

Add.

1. $\begin{array}{r} 92 \\ + 6 \\ \hline 98 \end{array}$	2. $\begin{array}{r} 53 \\ + 43 \\ \hline 96 \end{array}$	3. $\begin{array}{r} 675 \\ + 20 \\ \hline 695 \end{array}$
4. $\begin{array}{r} 25 \\ + 3 \\ \hline 28 \end{array}$	5. $\begin{array}{r} 45 \\ + 32 \\ \hline 77 \end{array}$	6. $\begin{array}{r} 86 \\ + 512 \\ \hline 598 \end{array}$
7. $\begin{array}{r} 431 \\ + 568 \\ \hline 999 \end{array}$	8. $\begin{array}{r} 240 \\ + 513 \\ \hline 753 \end{array}$	9. $\begin{array}{r} 232 \\ + 214 \\ \hline 446 \end{array}$
10. $\begin{array}{r} \$7.24 \\ + 0.34 \\ \hline \$7.58 \end{array}$	11. $\begin{array}{r} \$2.36 \\ + 1.53 \\ \hline \$3.89 \end{array}$	

Subtract.

12. $\begin{array}{r} 97 \\ - 6 \\ \hline 91 \end{array}$	13. $\begin{array}{r} 56 \\ - 34 \\ \hline 22 \end{array}$	14. $\begin{array}{r} 164 \\ - 54 \\ \hline 110 \end{array}$
15. $\begin{array}{r} 76 \\ - 3 \\ \hline 73 \end{array}$	16. $\begin{array}{r} 87 \\ - 63 \\ \hline 24 \end{array}$	17. $\begin{array}{r} 689 \\ - 54 \\ \hline 635 \end{array}$
18. $\begin{array}{r} 978 \\ - 654 \\ \hline 324 \end{array}$	19. $\begin{array}{r} 797 \\ - 451 \\ \hline 346 \end{array}$	20. $\begin{array}{r} 399 \\ - 327 \\ \hline 72 \end{array}$
21. $\begin{array}{r} \$8.68 \\ - 6.17 \\ \hline \$2.51 \end{array}$	22. $\begin{array}{r} \$6.84 \\ - 2.32 \\ \hline \$4.52 \end{array}$	

Solve.

23. The parade has 23 tall clowns and 41 short clowns. How many clowns are in the parade? **64**
24. The clowns give away 165 balloons. 43 balloons are red. How many balloons are other colors? **122**

Add.

1. $\begin{array}{r} 83 \\ + 7 \\ \hline 90 \end{array}$	2. $\begin{array}{r} 27 \\ + 34 \\ \hline 61 \end{array}$	3. $\begin{array}{r} 48 \\ + 49 \\ \hline 97 \end{array}$
4. $\begin{array}{r} 92 \\ + 45 \\ \hline 137 \end{array}$	5. $\begin{array}{r} 182 \\ + 26 \\ \hline 208 \end{array}$	6. $\begin{array}{r} 143 \\ + 194 \\ \hline 337 \end{array}$
7. $\begin{array}{r} 128 \\ + 45 \\ \hline 173 \end{array}$	8. $\begin{array}{r} 265 \\ + 284 \\ \hline 549 \end{array}$	9. $\begin{array}{r} 472 \\ + 187 \\ \hline 659 \end{array}$
10. $\begin{array}{r} \$6.54 \\ + 2.63 \\ \hline \$9.17 \end{array}$	11. $\begin{array}{r} \$1.19 \\ + 7.37 \\ \hline \$8.56 \end{array}$	

Subtract.

12. $\begin{array}{r} 20 \\ - 6 \\ \hline 14 \end{array}$	13. $\begin{array}{r} 78 \\ - 59 \\ \hline 19 \end{array}$	14. $\begin{array}{r} 683 \\ - 25 \\ \hline 658 \end{array}$
15. $\begin{array}{r} 126 \\ - 34 \\ \hline 92 \end{array}$	16. $\begin{array}{r} 659 \\ - 394 \\ \hline 265 \end{array}$	17. $\begin{array}{r} 729 \\ - 258 \\ \hline 471 \end{array}$
18. $\begin{array}{r} 391 \\ - 58 \\ \hline 333 \end{array}$	19. $\begin{array}{r} 749 \\ - 370 \\ \hline 379 \end{array}$	20. $\begin{array}{r} 491 \\ - 402 \\ \hline 89 \end{array}$
21. $\begin{array}{r} \$8.97 \\ - 7.59 \\ \hline \$1.38 \end{array}$	22. $\begin{array}{r} \$3.08 \\ - 1.43 \\ \hline \$1.65 \end{array}$	

Solve.

23. 72 children have cats. 185 children have dogs. How many children have cats or dogs for pets? **257**
24. There are 82 pets at the pet show. 39 pets are cats. The rest are dogs. How many dogs are there? **43**

LESSON ACTIVITY

Using the Pages

- The section on the left of page 138 involves addition and subtraction with no regrouping. The section on the right of page 138 involves addition and subtraction with one regrouping. The section on the left of page 139 involves addition and subtraction with two regroupings. The section on the right of page 139 consists of problems involving addition and subtraction.
- Emphasize accuracy, speed, and understanding of regrouping.
- Probably these pages would be more interesting for the children and provide a more accurate assessment of their skill, if they complete each section at a different time. It is important that the teacher check each child's success in each section and determine specific needs for reviewing or reteaching of topics and for additional practice. The *Related Activities* offer suggestions for follow-up.

Add.

- | | | |
|--|--|--|
| 1. $\begin{array}{r} 75 \\ + 65 \\ \hline 140 \end{array}$ | 2. $\begin{array}{r} 89 \\ + 43 \\ \hline 132 \end{array}$ | 3. $\begin{array}{r} 67 \\ + 59 \\ \hline 126 \end{array}$ |
| 4. $\begin{array}{r} 398 \\ + 26 \\ \hline 424 \end{array}$ | 5. $\begin{array}{r} 194 \\ + 507 \\ \hline 701 \end{array}$ | 6. $\begin{array}{r} 375 \\ + 259 \\ \hline 634 \end{array}$ |
| 7. $\begin{array}{r} 296 \\ + 217 \\ \hline 513 \end{array}$ | 8. $\begin{array}{r} 434 \\ + 388 \\ \hline 822 \end{array}$ | 9. $\begin{array}{r} 162 \\ + 98 \\ \hline 260 \end{array}$ |
| 10. $\begin{array}{r} \$1.96 \\ + 4.56 \\ \hline \$6.52 \end{array}$ | 11. $\begin{array}{r} \$3.17 \\ + 3.83 \\ \hline \$7.00 \end{array}$ | |

Subtract.

- | | | |
|--|--|---|
| 12. $\begin{array}{r} 140 \\ - 78 \\ \hline 62 \end{array}$ | 13. $\begin{array}{r} 824 \\ - 676 \\ \hline 148 \end{array}$ | 14. $\begin{array}{r} 938 \\ - 449 \\ \hline 489 \end{array}$ |
| 15. $\begin{array}{r} 413 \\ - 229 \\ \hline 184 \end{array}$ | 16. $\begin{array}{r} 531 \\ - 285 \\ \hline 246 \end{array}$ | 17. $\begin{array}{r} 723 \\ - 696 \\ \hline 27 \end{array}$ |
| 18. $\begin{array}{r} 550 \\ - 356 \\ \hline 194 \end{array}$ | 19. $\begin{array}{r} 603 \\ - 236 \\ \hline 367 \end{array}$ | 20. $\begin{array}{r} 705 \\ - 278 \\ \hline 427 \end{array}$ |
| 21. $\begin{array}{r} \$8.10 \\ - 5.13 \\ \hline \$2.97 \end{array}$ | 22. $\begin{array}{r} \$8.00 \\ - 2.36 \\ \hline \$5.64 \end{array}$ | |

Solve.

23. One book has 288 pages. Another book has 294 pages. Brian read both books. How many pages did Brian read? **582**
24. Sue's book has 341 pages. She has read 165 pages. How many pages does Sue have left to read? **176**

Solve.

1. 43 children collect stamps. 17 children collect coins. How many more children collect stamps than coins? **26**
2. Joy had 214 stamps in her collection. She collected 59 new stamps. How many stamps does Joy have in all? **273**
3. Bob delivers 234 papers. Ray delivers 158 papers. How many fewer papers does Ray deliver? **76**
4. There are 182 customers on Jim's paper route. 30 are away on holiday and have stopped delivery. How many papers does Jim deliver? **152**
5. 80 adults buy tickets for the school concert. 84 children also buy tickets. How many buy tickets in all? **164**
6. 202 people are at the concert. 96 are adults. How many are children? **106**
7. Andy's jigsaw puzzle has 213 pieces. Meg's puzzle has 143 pieces more than Andy's. How many pieces are in Meg's puzzle? **356**
8. A jigsaw puzzle costs \$2.21. Bill gives the clerk \$4.01. How much money does Bill get back from the clerk? **\$1.80**
9. Ann buys a doll for \$2.85 and a game for \$3.79. How much does she spend? **\$6.64**

RELATED ACTIVITIES

- Work sheets to provide practice in addition could include addition squares, adding to find coded messages, or finding missing digits as in the following.

$$\begin{array}{r} \square 0 8 \\ + \quad 7 \square \\ \hline 7 \square 1 \end{array}$$

Children may like the challenge of preparing work sheets for others.

- The ideas in the preceding activity could be adapted for practicing subtraction.
- Children may enjoy making a collage or a book illustrating addition and subtraction with clippings from magazines or newspapers or with pictures drawn by the children.
- Children could create word problems to help them understand another aspect of problem solving.
- The children could illustrate word problems to increase their understanding.
- A play store in the classroom would provide opportunities to add and subtract with amounts of money. If the classroom does not have a play store, children could draw items on price tags for others to select two and then add to find the amount, or subtract to find the difference of the prices.

Unit 8 Overview

Multiplication

This unit introduces the concept of multiplication and explores basic facts for which one factor is 5 or less. The concept is first met in relation to equal groups and repeated addition. The multiplication sentence is then seen as a shorter way of describing equal groups. Thereafter, basic facts for products to 45 are derived through situations that involve not only equal groups but also the number line and, later in the unit, arrays. Special attention is given to zero and one because these numbers have special properties as factors. Arrays are also used in an examination of the commutative property of multiplication.

Prerequisite Skills

- add up to nine identical one-digit numbers

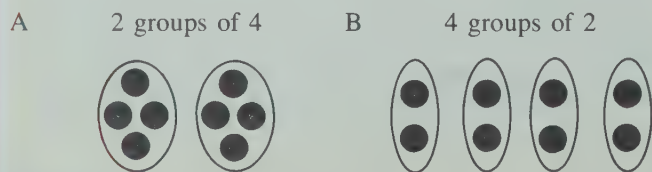
Unit Outcomes

- use repeated addition to describe equal groups; show equal groups
- write multiplication sentences to describe equal groups
- find the product with 2, 3, 4, or 5 as a factor, to 9×2 , 9×3 , 9×4 , 9×5
- draw an organized arrangement for given factors; write a multiplication sentence for an organized arrangement
- find the product with 0 or 1 as a factor
- complete basic multiplication facts with products to 45; solve related word problems
- write two multiplication sentences to describe an array; illustrate multiplication sentences with arrays
- multiply to find the number of objects by using a partly covered array
- draw pictures to solve word problems

Background

Multiplication is first approached through the operation of addition with which the children have had considerable experience. Repeated addition of the same number is related to multiplication of that number. If the children have had experiences counting by twos, threes, fours, and fives, they are probably familiar with some of the multiples of these numbers. By now, many children probably know a number of basic multiplication facts involving two and five, and only need to learn the appropriate vocabulary and symbols in order to express them.

Groups are used in the early stages as the vocabulary and symbols are carefully introduced. In the corresponding multiplication sentences the symbol \times is read as "times". The first factor in a multiplication sentence represents the number of groups and the second factor represents the size of each group. In A these features are illustrated for $2 \times 4 = 8$. In B the multiplication sentence $4 \times 2 = 8$ is read "four times two equals eight" and relates to four groups with two objects in each group.



$$4 + 4 = 8$$

$$2 \text{ groups of } 4 \text{ are } 8$$

$$2 \text{ times } 4 \text{ equals } 8$$

$$2 \times 4 = 8$$

$$2 + 2 + 2 + 2 = 8$$

$$4 \text{ groups of } 2 \text{ are } 8$$

$$4 \text{ times } 2 \text{ equals } 8$$

$$4 \times 2 = 8$$

Note that the symbol \times is not read "multiplied by" since this would indicate the opposite with respect to the number of groups and the size of each group.

Multiplication can be illustrated as equal jumps on the number line. For 4×2 , for example, children would start at zero and show four jumps of two. The transition is easily made from the concept of equal groups. Showing four groups of two for 4×2 corresponds to showing four jumps of two. It should be emphasized that the jumps always begin at zero and that the product is the number reached when the jumps are complete.



$$4 \times 2 = 8$$

Zero jumps can be understood if the children realize that zero as in 0×2 means "no jumps", and therefore there is no movement along the number line.

Zero and one are given particular attention as factors. Children will likely be able to generalize that the result is zero if one of the factors is zero. In multiplication, the number one is often referred to as the *identity element* because it does not change the number it multiplies or by which it is multiplied.

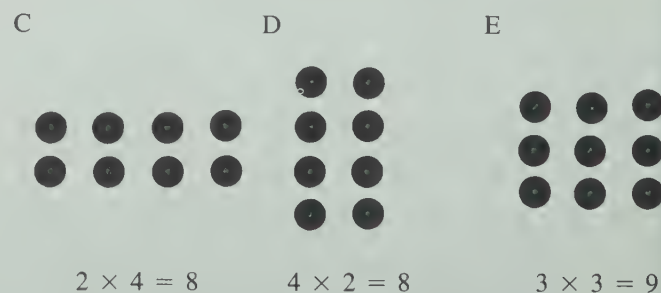
$$4 \times 0 = 0$$

$$4 \times 1 = 4$$

$$0 \times 4 = 0$$

$$1 \times 4 = 4$$

Probably one of the most effective aids in the work with multiplication is the *array*, which displays objects or symbols in a rectangular arrangement of rows and columns. The number of rows and the number of columns can be associated with the two factors of a product. The product corresponds to the number of objects in the array. Thus, an array clearly displays the two factors and the product for a multiplication fact. The arrays in C and D show that the product of 2 and 4 is 8. If the two factors are equal as for 3×3 in E, it is quickly recognized that the shape of the array is square rather than rectangular.

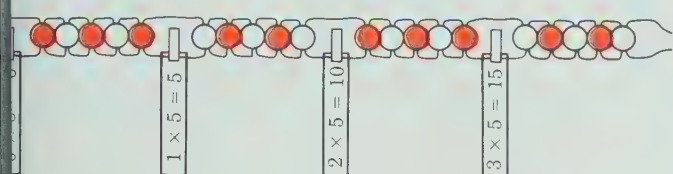


Arrays are ideal for demonstrating the commutative property of multiplication, which states that the order of multiplying the numbers does not affect the product. If the array in C is turned one-quarter turn, it matches the array in D. Thus, either array can be used to derive the two multiplication facts $4 \times 2 = 8$ and $2 \times 4 = 8$. If the factors are equal as in E, there is, of course, only one array and one multiplication sentence. Arrays play an important role in division when the inverse relationship between multiplication and division is studied and families of related multiplication and division facts are derived.

In the Overview of Unit 1, the meaning of basic addition and subtraction facts was discussed. The approach to multiplication also through basic facts. A *basic multiplication fact* has two one-digit factors as in $5 \times 8 = 40$ and $3 \times 7 = 21$. The smallest product for a basic multiplication fact is 81 for $9 \times 9 = 81$. By emphasizing basic multiplication facts, later work with the multiplication algorithm is made easier. In this unit, only basic facts with products to 45 are developed. Because of the commutative property the number of facts that must be learned is reduced considerably. For example, knowing $5 \times 5 = 25$ helps in knowing $5 \times 9 = 45$.

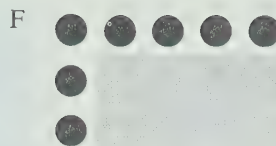
Teaching Strategies

For many children, this may be the first formal introduction to multiplication. Use of concrete materials by both the teacher and children is particularly important in developing the concept. To provide ample opportunity for children to work with objects to make from one to nine groups of objects for each of the numbers two, three, four, and five. A variety of objects, such as popsicle sticks, Unifix cubes, bottle caps, counters, blocks, buttons, and beans, can be obtained easily and made available in most classrooms. Small containers such as shallow boxes or lids are useful as set holders for small objects. Children may help to prepare a long string of "elevator beads" as described on page T348 and suspend the string from a hook. To have them separate the beads to show groups of 2, 3, 4, or 5. Cards showing multiplication facts may be clipped at various points along the string. If this device is to be used in Unit 15 to illustrate groups of from 6 to 10 beads, there should be one hundred beads on the string.



Following the concrete level of development, the number line is probably the most effective teaching-learning aid. Starting at zero, jumps of two to five units in length emphasize multiples of two, three, four, and five. If one of the two factors is zero, the product is seen to be zero. For example, 0×2 is interpreted as zero jumps of two and hence there are no jumps at all. Similarly, 2×0 is interpreted as two jumps of zero units (jumping up and down at the zero point), and so there is no movement along the number line.

Children should have experiences making arrays and relating them to corresponding multiplication sentences. Since the array is introduced as an organized way of showing equal groups, it is desirable to begin with groups of objects such as pennies or counters and have children display them in rows and columns. Later, arrays can be shown by using gummed shapes on cards or by sections of geopaper (page T366). A distinct advantage of the array is that the two factors are clearly displayed and the product is readily obtained through counting by rows or by columns. Also, children can be encouraged to memorize a fact if part of the array is removed and only the top row and the left column are shown. For array F, the factors 5 and 3 are presented and children can visualize the rest of the array to give the two multiplication facts $3 \times 5 = 15$ and $5 \times 3 = 15$.



This unit offers a variety of methods that children can use to find products. They should be encouraged to use these methods to develop their own multiplication sentences. Once they feel confident in finding products without these aids they should be allowed to do so. If children are assisted in organizing multiplication facts as they are discovered and used, the process of memorizing the facts is made easier. Children can summarize multiplication facts in the form of a book or chart beginning with facts of two and continuing with facts of three, four, and so on, as they are learned.

Facts of 2	
$0 \times 2 = 0$	
$1 \times 2 = 2$	
$2 \times 2 = 4$	
$9 \times 2 = 18$	

Games and activities described in the teaching suggestions for the lessons can provide reinforcement and motivation for memorizing multiplication facts. The development of multiplication includes the concept of finding the missing factor in sentences such as $6 \times \underline{\quad} = 30$ and $\underline{\quad} \times 3 = 12$. It also includes incidental discussion such as, "How many twos are eight?" or "How many fives are thirty?" These, of course, hint at the related division concepts which are formally met in Unit 9.

Materials

9 paper plates
18 straws or toothpicks for each child
number line; copy of page T359 for each child
45 counters for each child

Vocabulary

column	factor	multiplication sentence
row	product	times
array		

LESSON OUTCOME

Use repeated addition to describe equal groups; show equal groups

Materials

up to 20 counters (golf tees or blocks),
9 paper plates

Prerequisite Skills

Add identical one-digit numbers

Checking Prerequisite Skills

Add.

1. $2 + 2 = 4$
2. $3 + 3 + 3 = 9$
3. $6 + 6 + 6 = 18$
4. $0 + 0 + 0 = 0$

Background

In Unit 8 the concept of multiplication is explored through repeated addition, the number line, and arrays. The multiplication facts presented have products up to 45 with one factor from 0 to 5 and the other factor from 1 to 9.

8 MULTIPLICATION

Repeated Addition



4 groups of 2 bottles.
How many bottles in all?



$$2 + 2 + 2 + 2 = 8$$

4 groups of 2 are 8.
There are 8 bottles in all.

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LESSON ACTIVITY

Before Using the Pages

- Have the children arrange four counters on each of three paper plates. Emphasize that all the plates have the same number of counters. Encourage the children to explore different ways of determining the number of counters in all. Some may add the counters by ones, other may count by fours, or a few may use another way to find the number of counters in all. After allowing time for free exploration, guide them by asking:

“How many groups of counters are there?”

“How many counters are in each group?”

“How many counters are there in all?”

Repeat this exploration using similar examples with up to 20 counters. Include an example with zero counters on each plate.

Using the Pages

- Use the photograph to motivate a discussion about multiplication. Extend the discussion to the worked example. Discuss the number of groups of bottles, the number of bottles in each group, and the number of bottles in all. Develop that “four groups of two” means “four twos” or “ $2 + 2 + 2 + 2$ ”. Emphasize that repeated addition can be used because each group has the same number of objects.

Working Together: The exercises show how repeated addition can be used to determine the number of objects for equal groups. Provide more examples if needed.

Exercises: Two examples are provided to guide the children in completing the exercises. Emphasis is placed on the use of repeated addition to find the number of objects in all equal groups. Ex. 10 provides experience with zero as a factor. Children may enjoy discussing their diagrams. Ex. 3-11.

Working Together

- How many groups of bottles? 3
- How many in each group? 6
- Complete these sentences.

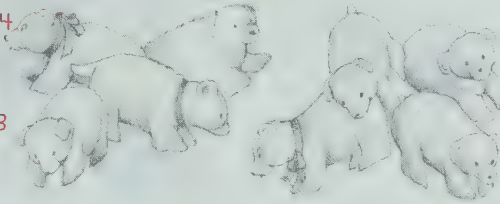
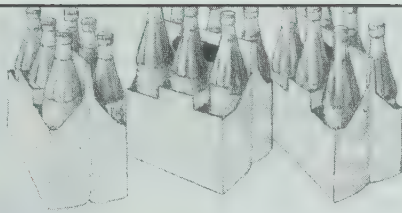
$$6 + 6 + 6 = 18$$

3 groups of 6 are 18

- How many groups of bears? 2
- How many in each group? 4
- Complete these sentences.

$$4 + 4 = 8$$

2 groups of 4 are 8



Exercises

Write two sentences for each picture.

Example:

For



$$5 + 5 = 10$$

- 2 groups of 5 are 10

write $4 + 4 + 4 = 12$
and 3 groups of 4 are 12.

- 4 groups of 3 are 12



Draw a picture and write two sentences for each.

Example: 2 groups of 3

Draw



Write and $3 + 3 = 6$
2 groups of 3 are 6.

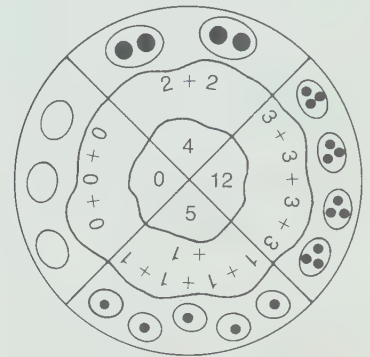
- | | | |
|---------------------------------|-----------------------------|--------------------------|
| 3. 3 groups of 5 | 4. 5 groups of 3 | 5. 3 groups of 1 |
| 6. 6 groups of 4 | 7. 5 groups of 2 | 8. 2 groups of 6 |
| 9. 3 groups of 3 | 10. 6 groups of 0 | 11. 4 groups of 4 |
| 3. $5 + 5 + 5 = 15$ | 4. $3 + 3 + 3 + 3 + 3 = 15$ | 5. $1 + 1 + 1 = 3$ |
| 6. $4 + 4 + 4 + 4 + 4 + 4 = 24$ | 7. $2 + 2 + 2 + 2 + 2 = 10$ | 8. $6 + 6 = 12$ |
| 9. $3 + 3 + 3 = 9$ | 10. $0 + 0 + 0 + 0 + 0 = 0$ | 11. $4 + 4 + 4 + 4 = 16$ |
| 3 groups of 5 are 15 | 5 groups of 3 are 15 | 3 groups of 1 are 3 |
| 6 groups of 4 are 24 | 5 groups of 2 are 10 | 6 + 6 = 12 |
| 3 groups of 3 are 9 | 6 groups of 0 are 0 | 4 groups of 4 are 16 |

RELATED ACTIVITIES

• Begin a multiplication display for Unit 8. Daily additions to the display would keep it current for encouragement and review. For the display, children could look in magazines for pictures that show equal groups.

• To emphasize the concept of equal groups, have children group sets of up to 45 counters (golf tees or blocks) into equal subsets. Although the multiplication facts in this unit have only up to 9 as one factor, children might also be interested in finding the number of equal groups of 2, 3, and 4 in sets of up to 45.

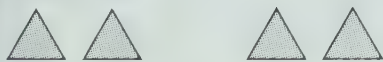
• To emphasize the relationship among groups of objects, repeated addition, and the number of objects in all, prepare circle puzzles similar to the one shown for children to fit together.



• Children may work in pairs. One child arranges equal groups of counters and the other child writes the corresponding addition sentence. Then the roles are reversed.

Assessment

Complete the sentences.



$$2 + 2 + 2 = 6$$

3 groups of 2 are 6

Draw a picture and write two sentences for each.

- 6 groups of 3
- 5 groups of 4



$$4 + 4 + 4 + 4 + 4 = 20$$

5 groups of 4 are 20

$$3 + 3 + 3 + 3 + 3 + 3 = 18$$

6 groups of 3 are 18

LESSON OUTCOME

Write multiplication sentences to describe equal groups

Materials

up to 20 counters for each child, 18 straws or toothpicks for each child

Vocabulary

multiplication sentence, times

Prerequisite Skills

Use repeated addition to describe equal groups; show equal groups

Checking Prerequisite Skills


Draw a picture and write an addition sentence for each.

1. 3 groups of 5
2. 4 groups of 1
3. 2 groups of 7
4. 8 groups of 0

1.  $5+5+5=15$

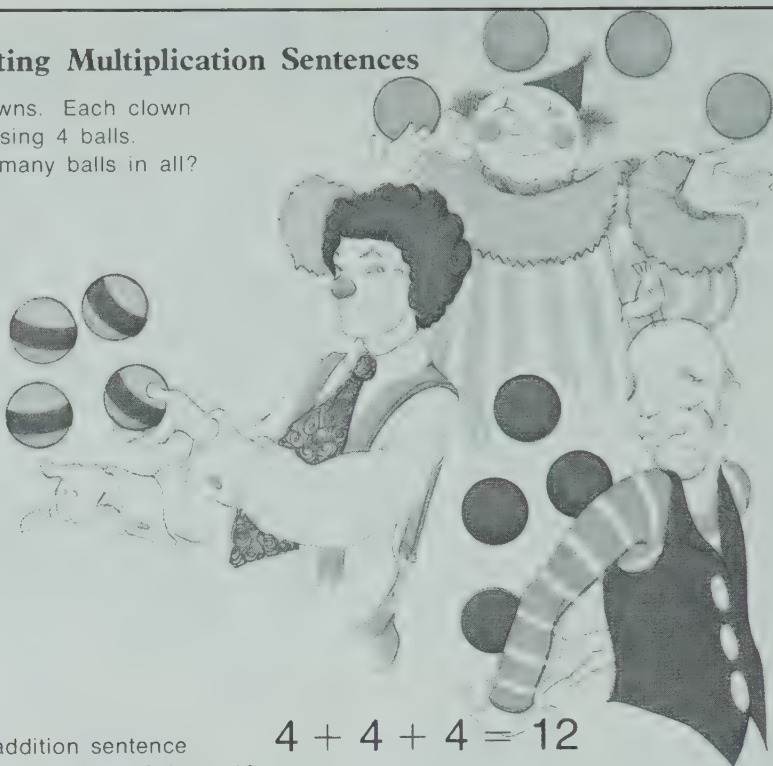
2.  $1+1+1+1=4$

3.  $7+7=14$

4.  $0+0+0+0+0+0+0+0=8$

Writing Multiplication Sentences

3 clowns. Each clown is tossing 4 balls. How many balls in all?



The addition sentence shows 3 groups of 4 are 12.

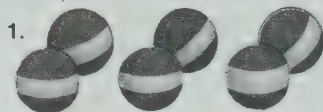
The multiplication sentence also shows 3 groups of 4 are 12.

$$4 + 4 + 4 = 12$$

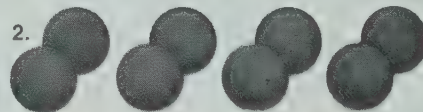
$$3 \times 4 = 12 \quad \text{3 times 4 equals 12.}$$

Working Together

Give an addition sentence and a multiplication sentence for each picture.



$2+2+2=6$ $3 \times 2=6$
Draw a picture and give a multiplication sentence for each.



$2+2+2+2=8$ $4 \times 2=8$

3. 2 groups of 6 $2 \times 6 = 12$

4. 3 times 1 $3 \times 1 = 3$

5. $5 \times 3 = 15$

6. $1 \times 5 = 5$

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LESSON ACTIVITY

Before Using the Pages

- Have the children arrange nine groups of two toothpicks or straws. Ask a child to write the addition sentence on the board to describe the situation. Lead the children to realize that the addition sentence is long.

Using the Pages

- The illustration of clowns may motivate a discussion which could be used to introduce the word problem. Have the children determine the number of balls in all using repeated addition.

Present the multiplication sentence as a short way to show repeated addition. Develop the fact that the 3 means three groups of objects and the 4 means four objects in each group. Point out that \times means *times* and that \times or *times* replaces "groups of" in the phrase "3 groups of 4".


Working Together: For Ex. 1 and 2, compare the addition and the multiplication sentences as methods of describing equal groups. In the multiplication sentence the first number shows the number of equal groups, and the second number shows how many there are in each group. Point out that the addition and the multiplication sentences convey the same meaning, but the multiplication sentence is shorter. Ex. 3- show different ways of expressing multiplication.

Exercises: Emphasis is placed on understanding the concept of multiplication. The pictures assist the children in finding the products to complete their multiplication sentences. Mastery of multiplication facts is not expected at this time.

Try This: Provide straws or toothpicks to allow the children to experiment. There are a variety of ways children may create the shapes. They may use each group of straws to form one shape. After the children have had time for experimenting, encourage them to build with the straws so that composite shapes are formed. They may build shapes side

Exercises

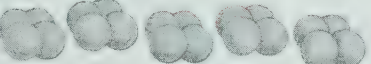
Write a multiplication sentence for each picture.

1.  $5 \times 2 = 10$

2.  $4 \times 6 = 24$

3.  $3 \times 5 = 15$

4.  $1 \times 3 = 3$

5.  $5 \times 4 = 20$

6.  $3 \times 6 = 18$

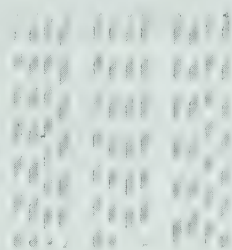
7.  $4 \times 1 = 4$

8.  $4 \times 5 = 20$

Draw a picture and write a multiplication sentence for each.

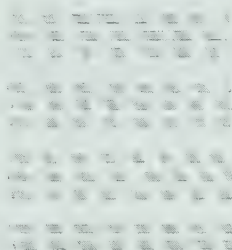
- | | |
|---------------------------------------|--|
| 9. 2 groups of 5
$2 \times 5 = 10$ | 10. 4 groups of 4
$4 \times 4 = 16$ |
| 11. 5 times 1
$5 \times 1 = 5$ | 12. 6 times 2
$6 \times 2 = 12$ |
| 13. $3 \times 3 = 9$ | 14. $1 \times 4 = 4$ |
| 15. $6 \times 4 = 24$ | 16. $2 \times 3 = 6$ |
| 17. $5 \times 5 = 25$ | 18. $4 \times 3 = 12$ |

Here are 3 groups of 4 straws.



1. Use all the straws. How many squares can you make?

Here are 4 groups of 3 straws.



2. Use all the straws. How many triangles can you make?
Answers will vary. See Using the Pages.

(Don't bend any straws!)


try this

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RELATED ACTIVITIES

• To provide more practice give each child a paper divided into nine squares. In each square the children draw equal groups of objects and write an addition and a multiplication sentence for each.


• Children may ring equal groups of nails on geoboards with rubber bands or equal groups of dots on geopaper. Then they could record the number of groups of nails, the number of nails in each group, the addition sentence, and the multiplication sentence.


• You could prepare cards such as  showing from zero to five dots and numeral cards for 0 to 9. The cards with dots give the number of dots in each group. The numeral cards show the number of groups. Children take one of each type of card, draw the groups indicated, and record a multiplication sentence. For example, if a child takes a card showing five dots and a numeral card for 2, he/she draws a picture of two groups of five and writes $2 \times 5 = 10$.

• Pairs of cards similar to the following could be prepared for the game "Snap" on page T 349.

$3 + 3 + 3 + 3$

4×3


by side like this  ; they may overlap shapes like


this  ; they may build three-dimensional shapes as

on page 74.

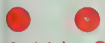
Assessment


Write a multiplication sentence for each picture.

 $2 \times 3 = 6$

2.  $3 \times 4 = 12$

Draw a picture and write a multiplication sentence for each.

2 groups of 1
 $2 \times 1 = 2$

4. 5 groups of 6
 $5 \times 6 = 30$

LESSON OUTCOME

Find the product with 2 as a factor, to 9×2

Materials


a copy of page T 359 for each child

Prerequisite Skills

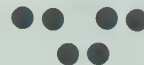
Use multiplication sentences to describe groups of two

Checking Prerequisite Skills

Write a multiplication sentence for each picture.

1. 

$5 \times 2 = 10$

2. 

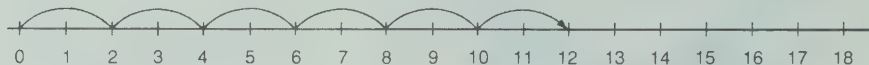
$3 \times 2 = 6$

RELATED ACTIVITIES

- For an activity to encourage children to be aware of groups of two in their environment, divide the class into teams of three or four. Give a pencil and paper to a "recorder" in each team. In two minutes, each team lists as many examples as possible of things that are usually found in twos. The team with the most examples wins. The lists could be labeled "Groups of Two" and placed with the multiplication display.
- Children may enjoy keeping score for a game by twos or they could skip and count the jumps by twos.

Exploring Facts Using 2

Start at 0 and make 6 jumps of 2 on a number line. Where do you land?

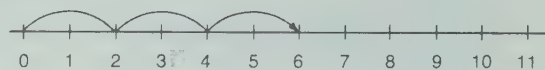


$$6 \times 2 = 12$$

6 jumps of 2 end at 12.

Working Together

This number line shows jumps of 2. Complete each of these.



- 3 jumps of 2
- 3 jumps of 2 end at 6
- $\times 2 =$

Mark a number line and give a multiplication sentence for each.

- 5 jumps of 2 $5 \times 2 = 10$
- $9 \times 2 = 18$
- $0 \times 2 = 0$

Exercises

Mark a number line and write a multiplication sentence for each.

- $5 \times 2 = 10$
- $2 \times 2 = 4$
- $7 \times 2 = 14$
- $4 \times 2 = 8$

Multiply. Use a number line if you need to.

- $6 \times 2 = 12$
- $3 \times 2 = 6$
- $1 \times 2 = 2$
- $8 \times 2 = 16$

Complete.

- $\times 2 = 10$
- $\times 2 = 16$
- $\times 2 = 8$
- $\times 2 = 14$

LESSON ACTIVITY

Before Using the Page

- Tell three children to raise both hands together. Ask:
 - "How many groups of hands are there?"
 - "How many hands are in each group?"
 - "How many hands are there in all?"
 - "What is the multiplication sentence to describe this?"
 (Some children will probably count the hands to determine the number of hands in all. This may provide an opportunity to show counting by twos, repeated addition, and multiplication as ways of finding the number in all for equal groups. The purpose of this lesson is to explore multiplication facts with two as a factor and to explore the meaning of multiplication.)

Using the Page

- Present the number line as a way to show jumps of two. A group is replaced by a jump. Point out that the arrow indicates the direction of the jumps. The arrow also shows

the number of equal jumps or groups and the size of each jump or group. The arrow begins at zero and ends at the product.

Working Together: Ex. 1-3 indicate steps used to find the product. Have the children use these steps to find the products for Ex. 4-6. For the first few examples, draw a number line on the board. Then have the children work on their own, using copies of page T 359. Discuss Ex. 7, pointing out that since there are zero jumps of two, no jumps can be shown on the number line.

Exercises: Children would benefit from a discussion about Ex. 7. There is one jump of two and the product is the same as the length of the jump.

Assessment

Mark a number line and write a multiplication sentence for each

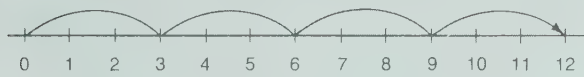
- $7 \times 2 = 14$
- $4 \times 2 = 8$
- $1 \times 2 = 2$

Multiply. Use a number line if you need to.

- $8 \times 2 = 16$
- $0 \times 2 = 0$

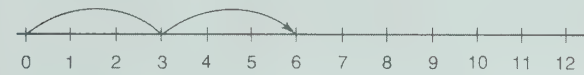
Exploring Facts Using 3

The jumps on this number line show 4×3 .



$$4 \times 3 = 12$$

The jumps on this number line show 2×3 .



$$2 \times 3 = 6$$

Exercises

Mark a number line and write a multiplication sentence for each.

1. $3 \times 3 = 9$ 2. $7 \times 3 = 21$ 3. $1 \times 3 = 3$ 4. $8 \times 3 = 24$

Multiply. Use a number line if you need to.

5. $5 \times 3 = 15$ 6. $0 \times 3 = 0$ 7. $9 \times 3 = 27$ 8. $6 \times 3 = 18$
 9. $3 \times 2 = 6$ 10. $6 \times 2 = 12$ 11. $2 \times 3 = 6$ 12. $8 \times 2 = 16$
 13. $5 \times 2 = 10$ 14. $4 \times 3 = 12$ 15. $9 \times 2 = 18$ 16. $2 \times 2 = 4$

Complete.

17. $6 \times 3 = 18$ 18. $3 \times 3 = 9$ 19. $5 \times 3 = 15$ 20. $8 \times 3 = 24$

Copy and complete the patterns.

21. 2, 4, 6, 8, 10, 12, 14, 16, 18
 22. 3, 6, 9, 12, 15, 18, 21, 24, 27

Write a multiplication sentence and answer each question.

23. 5 clowns.
3 hats for each clown. $5 \times 3 = 15$
How many hats in all? 15
 24. 9 children.
3 tickets for each child. $9 \times 3 = 27$
How many tickets in all? 27
 25. 4 drinks.
2 straws for each drink. $4 \times 2 = 8$
How many straws in all? 8
 26. 7 ice cream cones.
2 scoops on each cone. $7 \times 2 = 14$
How many scoops in all? 14

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LESSON OUTCOME

Find the product with 3 as a factor, to 9×3

Materials

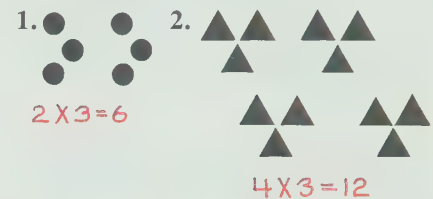
a copy of page T 359 for each child

Prerequisite Skills

Use multiplication sentences to describe groups of three; use a number line to find products

Checking Prerequisite Skills

Write a multiplication sentence for each picture.



Mark a number line and write a multiplication sentence for each.

3. $3 \times 2 = 6$ 4. $5 \times 2 = 10$

RELATED ACTIVITIES

- To encourage children to be aware of groups of three in their environment, adapt the activity on page T 158 for listing examples.
- Children could draw a number line on the playground and jump or hop by threes.

LESSON ACTIVITY

Before Using the Page

Ask the children for examples of things that are in groups of three, such as wheels on a tricycle. Have the children suggest stories and nursery rhymes that involve the number three, such as *The Three Bears*, *The Three Little Pigs*, and *Three Blind Mice*.

Using the Page

Tell the children that the number line can show jumps of three as well as jumps of two. Remind them that the arrow indicates the direction of the jumps and the number of jumps. Have the children trace the arrows for the worked examples with their fingers as they state the number indicated at the end of each jump.

Exercises: Ex. 21 and 22 present patterns which are another way to become familiar with products.

For Ex. 23-26, have the children answer each question in a sentence.

After the children have completed the exercises, discuss Ex. 6. Point out that since there are zero jumps of three, no jumps can be shown on the number line and thus the product is zero.

Assessment

Mark a number line and write a multiplication sentence for each.

1. $4 \times 3 = 12$ 2. $6 \times 3 = 18$

Multiply. Use a number line if you need to.

3. $0 \times 3 = 0$ 4. $2 \times 3 = 6$ 5. $8 \times 3 = 24$

LESSON OUTCOME

Draw an organized arrangement for given factors; write a multiplication sentence for an organized arrangement (one factor is either 2 or 3)

Materials

15 counters (golf tees or blocks) for each child

Vocabulary


factor, product

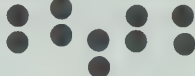
Prerequisite Skills

Write multiplication sentences for groups of two and groups of three; illustrate multiplication facts for two and for three

Checking Prerequisite Skills

Write a multiplication sentence for each picture.

1.  $1 \times 3 = 3$

2.  $5 \times 2 = 10$

Draw a picture and write a multiplication sentence for each of these.

3. $6 \times 2 = 12$ 4. $4 \times 3 = 12$

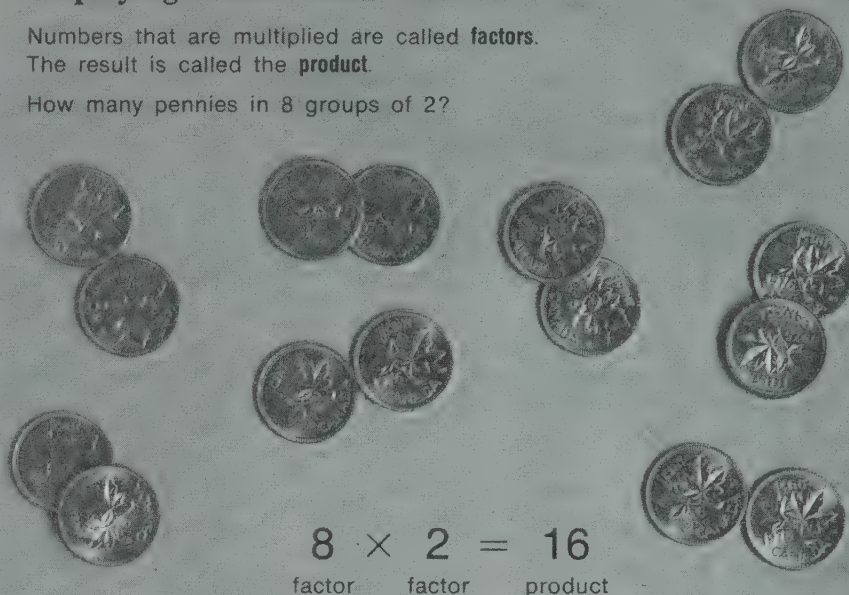
Background

The arrangement suggested in this lesson is the array. The word *array* is formally introduced on page 154.

Displaying Factors and Products

Numbers that are multiplied are called **factors**. The result is called the **product**.

How many pennies in 8 groups of 2?



$8 \times 2 = 16$

factor factor product

Working Together

In the multiplication sentence $7 \times 3 = 21$,

- which numbers are the factors? 7, 3
- which number is the product? 21

Tell which picture matches each pair of factors. Then give a multiplication sentence for each pair.

3. 5×2

A $5 \times 2 = 10$

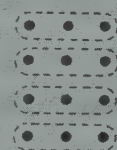
4. 4×3

B $4 \times 3 = 12$

Picture A



Picture B



Draw pictures with 3 ●'s in each row and give multiplication sentences to show

5. the product of the factors 6 and 3. $6 \times 3 = 18$

6. $3 \times 3 = 9$ 7. $1 \times 3 = 3$

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LESSON ACTIVITY

Before Using the Pages

- Tell the children to form five groups of three counters. Have them explore different ways of organizing these five groups of three to make it easier to find the number of counters in all. Ask children to explain how their arrangement facilitates determining the number of counters.

Using the Pages

- Read the information at the top of page 146. Then have the children explain the meaning of *factor* and *product* in their own words.
- Have the children count the eight groups of two pennies on page 146. Develop that one factor tells the number of groups and the other factor shows the number in each group. Then have the children count the eight groups of two pennies on page 147 as indicated by the thought clouds. Ask the children to compare this organization with the one

on page 146. Then read the information at the top of page 147 and suggest how this arrangement makes it easier to find the product.

Working Together: The exercises provide an opportunity for the children to use the new vocabulary. Have the children name the factors in the illustrations for Ex. 3 and 4 and the array of pennies on page 147. For Ex. 5-7, ask the children how they know how many rows of ●'s to draw. Ex. 5-7 ask the children to draw rows, but not to ring the rows.

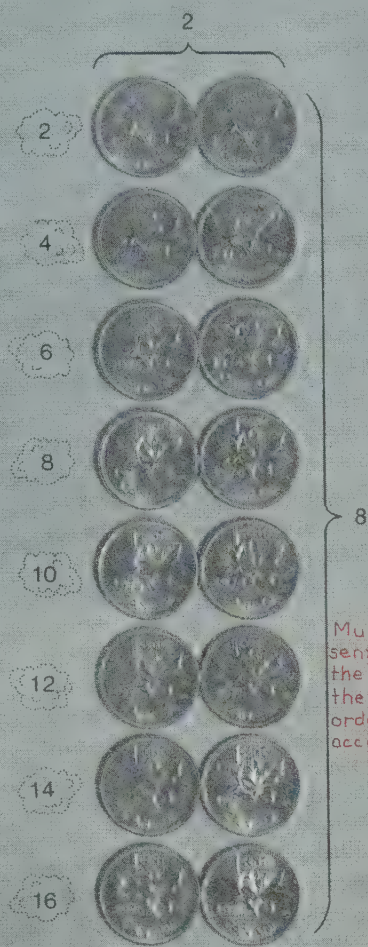
Exercises: These exercises allow the children to explore the concept of multiplication in another way and to become familiar with the words *factor* and *product*.

Assessment

Draw pictures with ●'s lined up in rows and write multiplication sentences to show

- the product of the factors 6 and 2
- 5×3
- the product of 1 and 3
- 8×2

Placing the pennies like this can show the factors better. This also makes it easier to count to find the product.



There are 16 pennies in 8 groups of 2.

Exercises

Write a multiplication sentence for each picture.

1. $4 \times 2 = 8$

2. $5 \times 3 = 15$

3. $6 \times 2 = 12$

Draw pictures with ●'s lined up in rows and write multiplication sentences to show

4. the product of $3 \times 2 = 6$
the factors 3 and 2.
5. the product of $8 \times 3 = 24$
the factors 8 and 3.
6. the product of 2 and 3. $2 \times 3 = 6$
7. the product of 7 and 2. $7 \times 2 = 14$
8. $2 \times 2 = 4$
9. $9 \times 2 = 18$
10. $9 \times 3 = 27$
11. $4 \times 3 = 12$
12. $5 \times 2 = 10$
13. $1 \times 2 = 2$
14. $7 \times 3 = 21$
15. $6 \times 3 = 18$

Multiplication sentences with the factors in the opposite order are acceptable.

RELATED ACTIVITIES

- Children could arrange counters in an organized form and then explain the basis of their organization to others.
- Provide magazines for the children to find pictures that suggest an organized arrangement of equal sets to them. The children could then form small groups in which each child shows her/his picture and gives the multiplication sentence that can be associated with the picture.
- You could prepare riddle cards for children to solve. The card could say, "My factors are 7 and 3. Who am I?" The hints could follow the pattern of "My product is 12. One of my factors is 4." or "My product is 8. The sum of my factors is 6." The difficulty of the riddles could be varied to suit the group.
- For practice in relating factors, products, and arrays, children can play the game "Match Up" on page T 349, using a set of cards similar to the following for each of

$2 \times 2, 3 \times 2, \dots, 9 \times 2;$
 $2 \times 3, 3 \times 3, \dots, 9 \times 3.$



2×3

6

A set of matching cards consists of three cards showing the same number (an array card, a factor card, and a product card).

6 \times 2 = 12 or
2 \times 6 = 12

2. 5 \times 3 = 15 or
3 \times 5 = 15

3. 1 \times 3 = 3 or
3 \times 1 = 3

4. 8 \times 2 = 16 or
2 \times 8 = 16

LESSON OUTCOME

Find the product with 4 as a factor, to 9×4

Materials


a number line marked from 0 to 36, 20 counters for each child

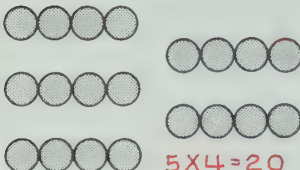
Prerequisite Skills

Use multiplication sentences to describe groups of four

Checking Prerequisite Skills

Write a multiplication sentence for each picture.

1.  $3 \times 4 = 12$

2.  $5 \times 4 = 20$

Exploring 4 as a Factor

The Mounties rode in rows of 4.
How many Mounties in 7 rows?



$$7 \times 4 = 28$$

There are 28 Mounties in 7 rows.

Working Together

Draw pictures with 4 ●'s in each row and give multiplication sentences to show

- the product of 6 and 4. $6 \times 4 = 24$
- the product of 1 and 4. $1 \times 4 = 4$

Multiply. Draw a picture if you need to.

- $2 \times 4 = 8$
- $8 \times 4 = 32$
- $7 \times 4 = 28$

Exercises

Draw pictures with 4 ●'s in each row and write multiplication sentences to show

- the product of 9 and 4. $9 \times 4 = 36$
- the product of 3 and 4. $3 \times 4 = 12$

Write a multiplication sentence to show how many Mounties in

- 5 rows of 4. $5 \times 4 = 20$
- 0 rows of 4. $0 \times 4 = 0$
- 4 rows of 4. $4 \times 4 = 16$

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LESSON ACTIVITY

Before Using the Pages

- Ask for examples of things that are in groups of four, such as four legs on a chair or a table.
- While one child sets out a row of four counters, have another child draw a row of four circles. Referring first to the counters, and later to the circles, ask:
"How many rows are there?"
"How many are in each row?"
"How many are there in all?"

Record this jump on the number line.

Have another child set out another row of four counters, at the same time as another child draws a row of four circles. Ask the same questions as before and record this jump on the number line.

Repeat this until nine rows of four are completed.

- Encourage the children to discuss number patterns shown on the number line.

Using the Pages

- Point out that there are four Mounties in each row. The discuss the worked example reminding the children that one factor tells the number of groups and the other tells the number in each group.

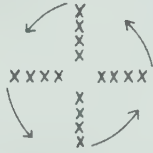
Working Together: The pictures enable the children to explore the meaning of multiplication sentences with four as a factor without knowing the products. The children could draw pictures for Ex. 3-5 or use the photograph of the Mounties. Remind the children that 2×4 , for example represents two rows of four.

Exercises: A few of the exercises review two and three as factors. The children could arrange counters, draw pictures, use a number line, use repeated addition, or refer to the photograph to find products.



When groups perform, drawings are used to help plan the show.

This drawing shows how 16 horses and riders could form a "windmill" with rows of 4.



Make a drawing that shows how 20 members of a marching band could form each of these.

1. Hi 2. OK

Show how

3. 18 horses could appear in 6 rows.
4. 18 horses could appear in 5 rows.
5. 8 dancers could form a circle.
6. 12 flag carriers could form a square.

Answers will vary.

PROBLEM SOLVING

RELATED ACTIVITIES

- To encourage children to be aware of groups of four in their environment, adapt the activity on page T158 for listing examples.
- Children may number each square in order on a copy of page T360 and then color every fourth square to show a multiple of four. You may wish to have them stop at 45 which is as far as multiplication extends in Unit 8. They could use this diagram to find and discuss patterns in the products of four.
- Children could create and draw answers for problems similar to those in *Problem Solving*. These drawings could be displayed.
- Have children complete a table similar to the following. (Copies of page T367 could be used.) Children may need to use counters or draw a number line to find the answers.

tables	1	2		5		9
legs	4		16			

Multiply. Draw a picture if you need to.

6. $2 \times 3 = 6$ 7. $5 \times 2 = 10$ 8. $2 \times 4 = 8$ 9. $6 \times 3 = 18$
 10. $8 \times 4 = 32$ 11. $5 \times 4 = 20$ 12. $6 \times 2 = 12$ 13. $9 \times 4 = 36$
 14. $9 \times 2 = 18$ 15. $8 \times 2 = 16$ 16. $4 \times 4 = 16$ 17. $6 \times 4 = 24$
 18. $7 \times 3 = 21$ 19. $7 \times 4 = 28$ 20. $3 \times 4 = 12$ 21. $0 \times 4 = 0$

Complete.

22. $7 \times \quad = 28$ 4 23. $8 \times \quad = 24$ 3
 24. $\quad \times 4 = 16$ 4 25. $\quad \times 4 = 4$ 1
 26. $7 \times \quad = 14$ 2 27. $4 \times \quad = 12$ 3

Problem Solving: Counters allow the children to experiment to create the arrangements and then copy them onto paper. Children may enjoy sharing their diagrams and comparing different ways of showing the arrangements. These would make an interesting display.

Assessment

Multiply. Draw a picture if you need to.

- $\quad \times 4 = 12$ 2. $1 \times 4 = 4$
 $\quad \times 4 = 24$ 4. $0 \times 4 = 0$

LESSON OUTCOME

Find the product with 5 as a factor, to 9×5

Materials


a number line from 0 to 45

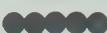
Prerequisite Skills

Use multiplication sentences to describe groups of five

Checking Prerequisite Skills

Write a multiplication sentence for each picture.

1.  $3 \times 5 = 15$

2.  $1 \times 5 = 5$

RELATED ACTIVITIES

- To encourage children to be aware of groups of five in their environment, adapt the activity on page T158 for listing examples. This list could be labeled "Groups of Five" and added to the multiplication display.
- Children may complete a table similar to the following using copies of page T367.

feet	1	2	3			9
toes	5				25	

Exploring 5 as a Factor

9 rows of chips. 5 bags in each row. How many bags of chips in all?

$$9 \times 5 = 45$$

There are 45 bags of chips in all.

Exercises

Write a multiplication sentence to show how many bags in

- 4 rows. $4 \times 5 = 20$
- 6 rows. $6 \times 5 = 30$
- 2 rows. $2 \times 5 = 10$
- 8 rows. $8 \times 5 = 40$
- 5 rows. $5 \times 5 = 25$
- 1 row. $1 \times 5 = 5$
- 3 rows. $3 \times 5 = 15$
- 7 rows. $7 \times 5 = 35$

Multiply. Draw a picture if you need to.

- $3 \times 5 = 15$
- $2 \times 5 = 10$
- $6 \times 3 = 18$
- $5 \times 5 = 25$
- $0 \times 2 = 0$
- $8 \times 3 = 24$
- $5 \times 2 = 10$
- $7 \times 4 = 28$
- $0 \times 5 = 0$
- $4 \times 5 = 20$
- $8 \times 2 = 16$
- $9 \times 5 = 45$
- $5 \times 3 = 15$
- $7 \times 5 = 35$
- $8 \times 5 = 40$
- $5 \times 4 = 20$

Complete.

- $\times 3 = 21$ 7
- $9 \times = 45$ 5
- $1 \times = 5$ 5
- $8 \times = 32$ 4
- $6 \times = 24$ 4
- $\times 2 = 18$ 9

Copy and complete these patterns.

- 4, 8, 12, 16, 20, 24, 28, 32, 36
- 5, 10, 15, 20, 25, 30, 35, 40, 45

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LESSON ACTIVITY

Before Using the Page

- Ask for examples of things that are in groups of five, such as the number of fingers on one hand or the number of school days in one week. Use this information to lead children to discover and discuss products of five up to 9×5 .
- On a number line from 0 to 45, ring multiples of 5, beginning with 0. Relate jumps on the line to multiplication facts with five as the second factor.

Using the Page

- Ask the children what number is being explored as a factor in this lesson.

Have the children verify that there are nine rows of bags with five bags in each row. Use a discussion of the photograph to introduce the worked example. Have the children use the photograph to answer the question in the worked example.

Then ask questions such as:

- “How many bags are in four rows?”
- “How many bags are in zero rows?”

Point out that the product always ends in five or zero.

Exercises: For Ex. 1-8, the children may refer to photograph. For Ex. 9-26, some children may wish to refer to a number line rather than draw pictures. In Ex. 27-32, one of the two factors is missing in each sentence and so children may need to refer to previous lessons to obtain answers. This is acceptable at this stage since the emphasis has been on understanding and discovery rather than memorization of multiplication facts. Ex. 33 and 34 may be completed by either skip counting or repeated addition.

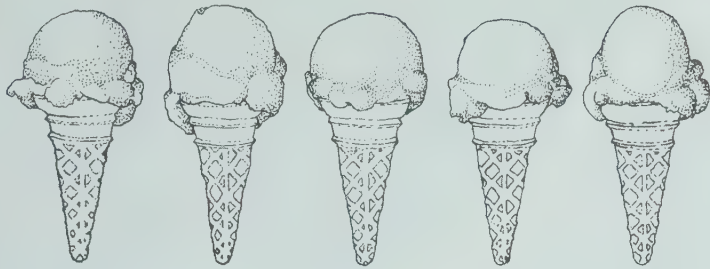
Assessment

Multiply. Draw a picture if you need to.

- $4 \times 5 = 20$
- $6 \times 5 = 30$
- $0 \times 5 = 0$
- $1 \times 5 = 5$

Exploring 0 or 1 as a Factor

How many scoops of ice cream in all?



$5 \times 1 = 5$
5 scoops.



$3 \times 0 = 0$
0 scoops.

Working Together

How many scoops in all?

- 1. 4 cones, 1 scoop in each.
 $4 \times 1 = 4$
- 2. 1 cone with 2 scoops.
 $1 \times 2 = 2$
- 3. 6 cones, 0 scoops in each.
 $6 \times 0 = 0$
- 4. 0 cones, there would have been 3 scoops in each cone.
 $0 \times 3 = 0$

Tell what happens in multiplying

- 5. when 1 is a factor. *The product is the other factor.*
- 6. when 0 is a factor. *The product is zero.*

Exercises

Multiply.

- | | |
|----------------------|----------------------|
| 1. $8 \times 1 = 8$ | 2. $5 \times 0 = 0$ |
| 3. $1 \times 0 = 0$ | 4. $1 \times 4 = 4$ |
| 5. $1 \times 1 = 1$ | 6. $0 \times 1 = 0$ |
| 7. $7 \times 0 = 0$ | 8. $9 \times 1 = 9$ |
| 9. $1 \times 3 = 3$ | 10. $0 \times 5 = 0$ |
| 11. $0 \times 0 = 0$ | 12. $6 \times 1 = 6$ |
| 13. $2 \times 0 = 0$ | 14. $1 \times 5 = 5$ |
| 15. $2 \times 1 = 2$ | 16. $4 \times 0 = 0$ |
| 17. $9 \times 0 = 0$ | 18. $7 \times 1 = 7$ |
| 19. $3 \times 1 = 3$ | 20. $0 \times 7 = 0$ |
| 21. $0 \times 2 = 0$ | 22. $8 \times 0 = 0$ |
| 23. $5 \times 1 = 5$ | 24. $0 \times 4 = 0$ |

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LESSON OUTCOME

Find the product with 0 or 1 as a factor

Materials

a number line from 0 to 9

Prerequisite Skills

Use multiplication sentences to describe groups of zero or of one

Checking Prerequisite Skills

Write a multiplication sentence for each picture.

- 1.
 $4 \times 1 = 4$
- 2.
 $3 \times 0 = 0$

RELATED ACTIVITIES

- Adapt the first activity on page T 158 for listing examples of groups of one and then of zero.
- You could prepare flash cards with an incomplete multiplication sentence with zero or one as a factor on the front and the complete multiplication sentence on the back. These cards could be used for practice by one child or for a game for a small group of children. A leader shows the front of the card and the first child to say the product takes the card. If no child answers correctly, the card is placed at the bottom of the pile. When all the cards are given out, the child with the most cards is the next leader.

LESSON ACTIVITY

More Using the Page

Have four children demonstrate one as a factor by assigning each to a different place in the classroom. Ask:
“How many groups of children are there?”
“How many children are in each group?”
“How many children are there in all?”
“What is a multiplication sentence that describes the number of children?”

Repeat this with different examples of groups of one.

Now show zero as a factor by pointing to four places for groups of children. Then say that there are no children in any of these groups. Ask the same questions as for the first activity.

Using the Page

For the first example, ask the same questions as for the first activity.

For the second example, point out that there are three

empty groups. Ask if the product would be different if there were more cones or if there were fewer cones. Develop that *if the groups are empty, the product is zero.*

Working Together: Ex. 4 shows zero groups instead of empty groups as in the worked example. Develop that *if there are no groups, the product is zero.* For Ex. 5 and 6 have as many children as possible express the answers in their own words.

Exercises: After the children have finished the exercises, have them ring each exercise with zero as a product. Ask why each product is zero and lead them to suggest that when one of the factors is zero, the product is zero. Have the children explain several exercises in terms of the number of cones and the number of scoops of ice cream in each cone.

Assessment

Multiply.

- 1. $2 \times 1 = 2$
- 2. $6 \times 0 = 0$
- 3. $7 \times 1 = 7$
- 4. $0 \times 5 = 0$
- 5. $1 \times 0 = 0$

OBJECTIVE

Recall basic multiplication facts with products to 45; solve related word problems



Practice

The fair is in town. For each problem, write a multiplication sentence and answer the question.

The multiplication sentences with the factors in the opposite order are acceptable.

1. 8 cars on the Tilt-a-Whirl.
3 children in each car.
How many are riding $8 \times 3 = 24$
the Tilt-a-Whirl? 24
2. 7 children want to ride
the Ferris Wheel. They need
2 tickets each. How many $7 \times 2 = 14$
tickets do they need in all? 14
3. The Scrambler can hold
3 children in each of
9 buckets. How many can $9 \times 3 = 27$
ride the Scrambler each time? 27
4. The Haunted House costs
4 tickets. How many
tickets do 5 children need $5 \times 4 = 20$
for the Haunted House? 20

152

LESSON ACTIVITY

Using the Pages

- Use the photographs to motivate a discussion about the children's experiences at a fair.
Point to a group of three children and ask how many children there would be in five such groups. Have children ask similar questions for other children to answer.
- Have children use a number line, repeated addition, counters, or draw a picture to find products they do not remember. Remind the children to answer the questions for Ex. 1-5 in sentences. Have the children discuss the reasons for their answers for Ex. 9 and 14.

Problem Solving: This provides practice in solving problems with more than one step. Some children may be able to solve the problem with the numbers only, whereas others may need to mark each group of people on a number line, use counters to represent the people. Have the children show their work to provide support for their answers. The children could discuss why there is a limit of sixteen people on the ride. This would encourage them to think about safety at a fair.



RELATED ACTIVITIES

- Children may enjoy creating and solving multiplication word problems. They could use the photographs on pages 152-153 for a theme, Ex. 6-14 for the numbers, and concentrate on thinking of multiplication situations.
- Playing the game "Product Search" described on page T 350 gives children practice in multiplying.

5. The roller coaster holds 2 people in each seat. There are 4 seats in a car. How $4 \times 2 = 8$ many can each car hold? 8

Multiply.

6. 9×2 18 7. 3×1 3 8. 7×3 21
 9. 6×0 0 10. 1×2 2 11. 8×5 40
 12. 7×4 28 13. 5×3 15 14. 0×4 0

Complete.

15. $8 \times \quad = 16$ 2 16. $\quad \times 3 = 18$ 6
 17. $4 \times \quad = 20$ 5 18. $9 \times \quad = 36$ 4

Safety rules do not allow more than 16 people on the Crazy Car ride. In the 8 cars on the ride, 5 cars have 2 people, 2 have 3 people, and 1 car has 1 person. Should the operator start the ride? no

**PROBLEM
SOLVING**

LESSON OUTCOME

Write two multiplication sentences to describe an array; illustrate multiplication sentences with arrays

Materials

10 counters for each child

Vocabulary



array, row, column

Prerequisite Skills

Write multiplication sentences to describe groups with products to 45

Checking Prerequisite Skills

Write a multiplication sentence.

- $2 \times 3 = 6$
- the product of 7 and 4 $7 \times 4 = 28$
- 
 $4 \times 3 = 12$
- 
 $5 \times 2 = 10$

Background

The commutative (order) property of multiplication states that the order of the factors does not affect the product. Although factors are often presented so that the first factor refers to the number of groups and the second factor refers to the number in each group, either order describes the situation. An array is one way of demonstrating the commutative property of multiplication.

LESSON ACTIVITY

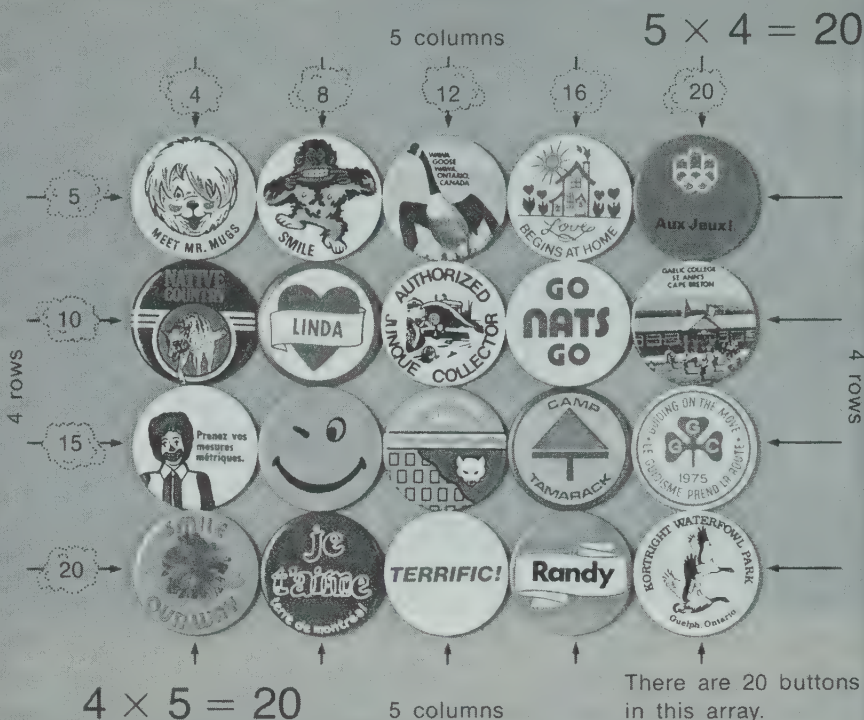
Before Using the Pages

- Display three groups of objects with two in each group. Ask the following questions.
 - "How many groups of objects are there?"
 - "How many objects are in each group?"
 - "How many objects are there in all?"

Then arrange the objects to form two groups with three objects in each group. Ask the same questions. Explore that there is the same number of objects in three groups of two as there is in two groups of three.
- Have the children arrange their counters lined up in rows to show five times two. Review that the rows and columns must be straight to facilitate counting the objects. (Some children may arrange their counters in five rows of two and others may arrange their counters in two rows of five. Both ways are correct.)

Showing a Product Two Ways

There are two multiplication sentences that show how many buttons are in this array.



Working Together

Draw an array with 5 rows and 3 columns of dots, and an array with 3 rows and 5 columns of dots.

- How many dots are in each array? 15
- Give two multiplication sentences for the arrays. $3 \times 5 = 15$
 $5 \times 3 = 15$

Draw an array of dots to show each product. Give two multiplication sentences for each array.

- the product of 2 and 6 $2 \times 6 = 12$
 $6 \times 2 = 12$
- the product of 4 and 3 $4 \times 3 = 12$
 $3 \times 4 = 12$

Using the Pages

- The children may enjoy discussing the buttons. Tell children that this arrangement is an *array*. Have them explain the meaning of *array* in their own words. Ask what advantage there is in arranging the buttons in an array. Have the children count the buttons in columns indicated by the thought clouds. Develop that five four is the same as four groups of five and therefore $5 \times 4 = 20$ is the same as $4 \times 5 = 20$. The order of factors does not change the product.

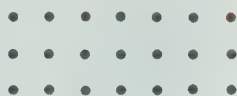
Working Together: Use these exercises to emphasize commutative (order) property of multiplication. Remind the children that making straight rows and columns is essential for drawing an array. Have the children turn their arrays to show that the array with five rows and three columns may be viewed as an array with three rows and five columns. Have them explore turning the arrays. Ex. 3 and 4 also.

Exercises

Use these arrays to answer the questions.

6. A: $7 \times 2 = 14$, $2 \times 7 = 14$
 B: $3 \times 7 = 21$, $7 \times 3 = 21$
 C: $6 \times 3 = 18$, $3 \times 6 = 18$
 D: $3 \times 6 = 18$, $6 \times 3 = 18$
 E: $5 \times 2 = 10$, $2 \times 5 = 10$
 F: $4 \times 6 = 24$, $6 \times 4 = 24$

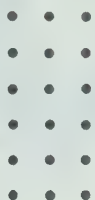
Array B



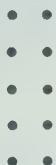
Array A



Array C



Array E





Array F



Array D



- Which array shows the product of 7 and 2? **A**
- Find two arrays that show the product of 3 and 6. **C, D**
- Draw another array that shows the product of 2 and 5. 

Draw two arrays for each 7.  of these.

- the product of 6 and 2
- the product of 3 and 4



Draw one array and write two multiplication sentences for the product of each pair.

- 3 and 2
- 4 and 7
- 3 and 2
- 4 and 7
- 2 and 4
- 6 and 5

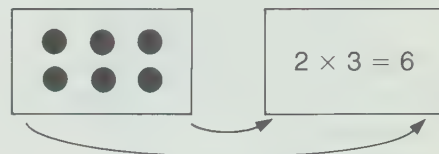
9. $3 \times 2 = 6$
 $2 \times 3 = 6$
 11. $4 \times 7 = 28$
 $7 \times 4 = 28$

10. $2 \times 4 = 8$
 $4 \times 2 = 8$
 12. $6 \times 5 = 30$
 $5 \times 6 = 30$

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RELATED ACTIVITIES

- Children could explore the commutative property of multiplication by arranging three groups of five counters and then arranging the same counters as five groups of three counters. Other numbers of groups and other numbers in each group could be used.
- Flash cards similar to the following with an array on one side and a multiplication sentence on the other side could be used as for the second activity on page T 165.



- Children may enjoy finding pictures that suggest arrays.
- For one child or a group of children to practice multiplying, you could prepare a tape with exercises in the following form: a multiplication fact such as 3×5 , a pause to give the children time to write the product, and then the product to allow the children to check their responses before answering the next exercise. For each exercise, one of the factors would be 1 to 9 and the other would be 0 to 5.

Exercises: The exercises provide examples of matching arrays and multiplication sentences.

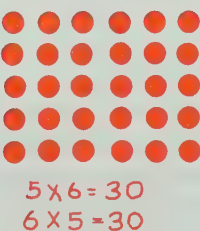
Assessment

Draw one array and write two multiplication sentences for the product of each pair.

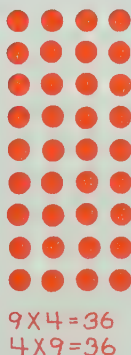
1. 2 and 3

$2 \times 3 = 6$
 $3 \times 2 = 6$

2. 5 and 6



3. 9 and 4



LESSON OUTCOME

Multiply to find the number of objects by using a partly covered array

Materials


a piece of paper and a pencil for each child


Prerequisite Skills

Write a multiplication sentence to describe an array

Checking Prerequisite Skills

Write a multiplication sentence for each array.

1. 
 $3 \times 4 = 12$ or
 $4 \times 3 = 12$

2. 
 $4 \times 2 = 8$ or
 $2 \times 4 = 8$

Background

For two different factors the number of rows is not the same as the number of columns in the array, and thus there are two multiplication sentences for each pair of factors. If, however, the two factors are the same, the number of rows is the same as the number of columns. In this case, there is only one multiplication sentence.

LESSON ACTIVITY

Using the Pages

- Read the information at the top of page 156. Have the children place their pieces of paper over the shape that partly covers the array. Then have them draw the flowers on their papers to complete each row and each column.

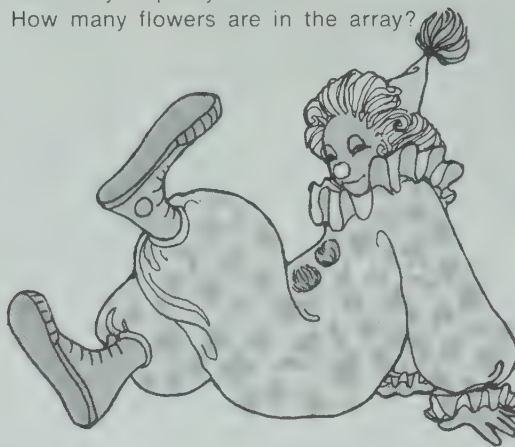
Ask how the number of rows can be determined. Develop that the number of objects in the column shows the number of rows. Ask how the number of columns can be found. Lead the children to suggest that the number of objects in the row shows the number of columns.

Read the remaining statements of the worked example. Explore methods of finding the number of flowers in an array. Lead the children to realize that they can count the flowers by ones, count by sixes, count by fours, add four sixes, add six fours, or use one of the methods of finding a product presented in a previous lesson.

Using Multiplication with Arrays

The array is partly covered.

How many flowers are in the array?

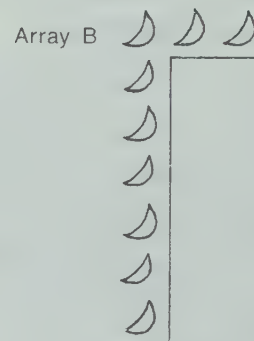
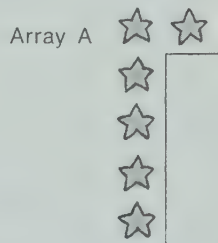


6 rows, 4 columns

$6 \times 4 = 24$ or $4 \times 6 = 24$

There are 24 flowers in the array.

Working Together



Answer these questions for each array.

- How many rows? A: 5 ; B: 7
- How many columns? A: 2 ; B: 3
- How many objects in all? A: 10 ; B: 21
- What are the two multiplication sentences? A : $5 \times 2 = 10$ B : $7 \times 3 = 21$
 $2 \times 5 = 10$ $3 \times 7 = 21$

Working Together: Ex. 1-3 shows the steps used to obtain multiplication sentences. Ex. 4 emphasizes that there are two multiplication sentences for each of these arrays.

Exercises: Only one multiplication sentence is asked for, there are two multiplication sentences that describe each of these arrays. The children may enjoy comparing different multiplication sentences they write. For Ex. 7 the answers can be checked by counting. Ex. 7-9 provide an opportunity to compare multiplication and addition to review that multiplication is shorter than addition.

Keeping Sharp: Ensure that the children remember how to follow the arrows. The exercises reinforce number patterns for multiplication and present repeated subtraction method used to introduce division.

Exercises Multiplication sentences with the factors in the opposite order are acceptable.

Write a multiplication sentence to show the number of objects in each array.

1. $3 \times 5 = 15$

☆ ☆ ☆ ☆ ☆

☆

2. $2 \times 3 = 6$

♥ ♥ ♥

♥

3. $6 \times 5 = 30$

☆ ☆ ☆ ☆ ☆

☆

4. $7 \times 3 = 21$

○ ○ ○

○

5. $6 \times 2 = 12$

✿ ✿

✿

6. $8 \times 4 = 32$

♥ ♥ ♥ ♥ ♥

♥

Write a multiplication sentence to show

7. the number of ☆'s. $3 \times 5 = 15$
8. the number of ✿'s. $2 \times 8 = 16$
9. the number of ○'s. $3 \times 4 = 12$

☆ ○ ☆ ○ ☆ ○ ☆ ○ ☆

✿ ✿ ✿ ✿ ✿ ✿ ✿ ✿

☆ ○ ☆ ○ ☆ ○ ☆ ○ ☆

✿ ✿ ✿ ✿ ✿ ✿ ✿ ✿

☆ ○ ☆ ○ ☆ ○ ☆ ○ ☆

Complete each subtraction chain.

1. $18 - 3 = 15$
 $15 - 3 = 12$
 $12 - 3 = 9$
 $9 - 3 = 6$
 $6 - 3 = 3$
 $3 - 3 = 0$

2. $20 - 4 = 16$
 $16 - 4 = 12$
 $12 - 4 = 8$
 $8 - 4 = 4$
 $4 - 4 = 0$

3. $25 - 5 = 20$
 $20 - 5 = 15$
 $15 - 5 = 10$
 $10 - 5 = 5$
 $5 - 5 = 0$

KEEPING SHARP

RELATED ACTIVITIES

- For practice in multiplying adapt the game "Check Off" on page T350. The list of numbers for Materials would be products for which one factor is from 0 to 5 and the other factor is from 1 to 9. The different ways of stating the numbers for the second step would be to name the factors for the numbers on the list.
- Children could prepare a table as shown.

×	1	2	3	4	5
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					

Then they complete the table. The table could be used for finding and discussing patterns in multiplication.

- Children may work in pairs using counters. One child arranges the top row and the left column of an array. The other child states the number of counters the array will have when it is completed. The first child completes the array to check.

Assessment

Write a multiplication sentence to show the number of objects in each array.

1. $4 \times 3 = 12$ or $3 \times 4 = 12$

2. $7 \times 2 = 14$ or $2 \times 7 = 14$

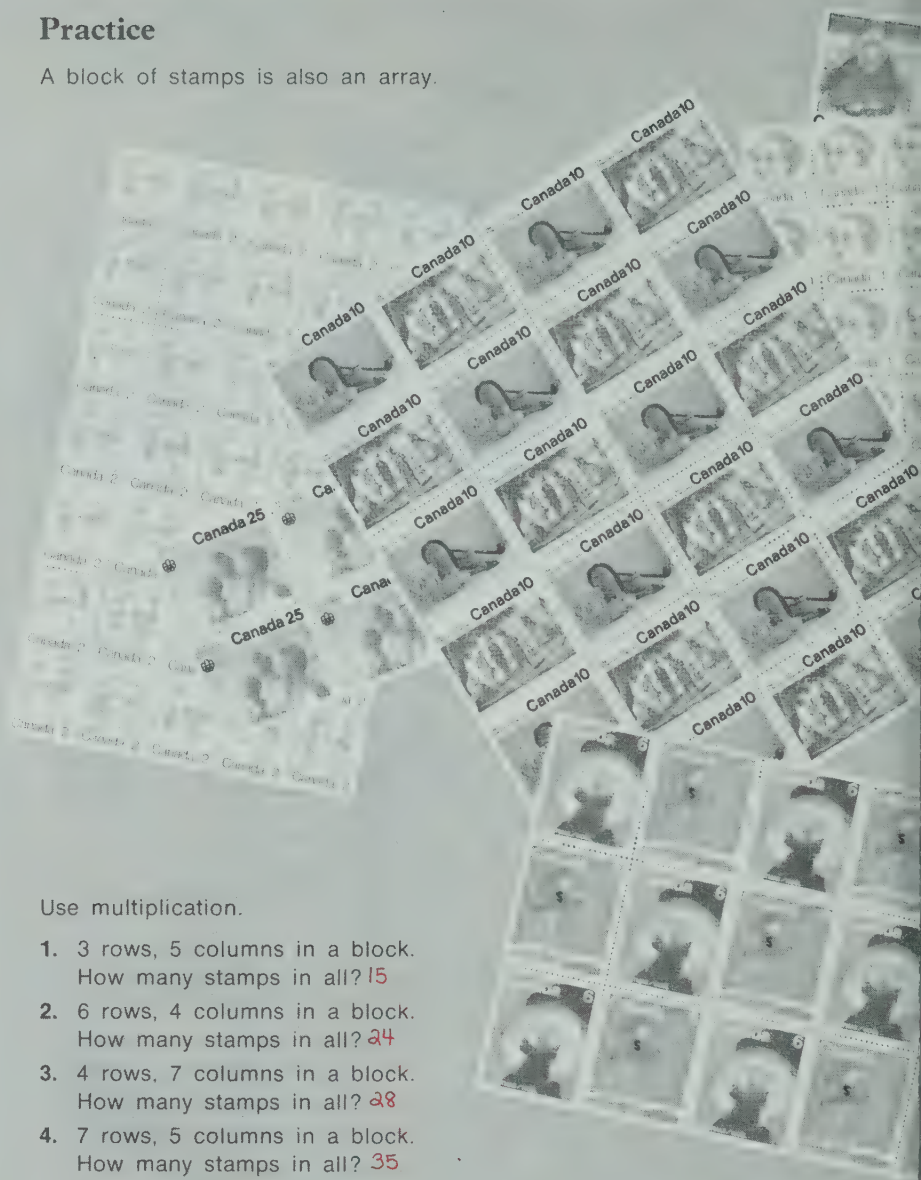
3. $4 \times 5 = 20$ or $5 \times 4 = 20$

OBJECTIVE

Demonstrate competence in multiplying and in using arrays

Practice

A block of stamps is also an array.



Use multiplication.

1. 3 rows, 5 columns in a block.
How many stamps in all? **15**
2. 6 rows, 4 columns in a block.
How many stamps in all? **24**
3. 4 rows, 7 columns in a block.
How many stamps in all? **28**
4. 7 rows, 5 columns in a block.
How many stamps in all? **35**

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LESSON ACTIVITY

Using the Pages

- Use the photograph to motivate a discussion about stamps and stamp collections. Explore the reason for the statement at the top of the page. Ask the children to multiply to find the number of stamps in each block of stamps. Discuss that the number of stamps can be determined for each block of stamps except the one that does not show the number of columns (the 25-cent stamps).
- Encourage the children to use the blocks of stamps on the page, a number line, or repeated addition to find any products they do not remember. Remind the children to answer Ex. 1-4 with a multiplication sentence and a statement. Finding the missing factor for Ex. 5-17 presents another aspect of multiplication and prepares the children for division in Unit 9. Children may need to review the symbols $>$ and $<$. Have the children note the similarities and the differences between the symbols for addition and multiplication.



Complete.

11. $3 \times \text{[stamp icon]} = 9$ 3
12. $4 \times \text{[stamp icon]} = 8$ 2
13. $\text{[stamp icon]} \times 3 = 21$ 7
14. $7 \times \text{[stamp icon]} = 14$ 2
15. $6 \times \text{[stamp icon]} = 30$ 5
16. $\text{[stamp icon]} \times 3 = 12$ 4
17. $5 \times \text{[stamp icon]} = 20$ 4

Use $<$, $>$, or $=$

18. 6×3 [stamp icon] $9 \times 2 =$
19. 2×4 [stamp icon] $8 \times 0 >$
20. 4×3 [stamp icon] $3 + 4 >$
21. 1×5 [stamp icon] $15 <$
22. 4×6 [stamp icon] $6 \times 4 =$
23. 8×3 [stamp icon] $9 \times 2 >$
24. 7×2 [stamp icon] $9 + 5 =$

How many rows or columns?

5. 18 stamps, 3 rows, [stamp icon] columns 6
6. 24 stamps, 6 rows, [stamp icon] columns 4
7. 12 stamps, [stamp icon] rows, 6 columns 2
8. 28 stamps, 4 rows, [stamp icon] columns 7
9. 35 stamps, [stamp icon] rows, 5 columns 7
10. 35 stamps, [stamp icon] rows, 7 columns 5

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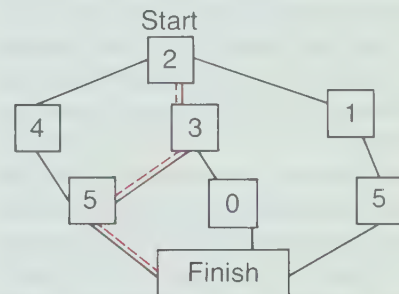
RELATED ACTIVITIES

- Children may enjoy finding examples of arrays in magazines or in their environment. Or they may enjoy drawing arrays. These could be displayed.
- Pairs of cards similar to the following could be prepared for the game "Concentration" on page T 349.

$$3 \times 4$$

$$12$$

- For more practice with multiplication, you could prepare a work sheet with exercises similar to the following. Color the multiplication path for 30.



The difficulty of the paths can be varied according to the ability of the group. (Ensure that the multiplication required for each path includes only the factors the children have experienced multiplying.)

- Have children explore ways of buying a block of stamps, for example, twenty-four stamps. Graph paper will assist them with their exploration. They will be experiencing factors greater than nine, but only in exploration.

OBJECTIVE

Draw pictures to solve word problems

Background

Drawing a picture often leads to a solution for a word problem. Therefore, children would benefit from trying to draw a picture for any problem that seems difficult.

RELATED ACTIVITIES

- Children may enjoy illustrating other word problems in the book.
- You may wish to provide similar problems to be solved with the help of pictures. The following are some suggestions.

1. The prizes for a game at the fair are hats. Two of the seven green hats have feathers. Five of the six blue hats have feathers. Seven of the eight red hats have feathers. None of the four yellow hats have feathers. There are no other hats. Are there more hats with or without feathers?

2. Anne won three more prizes than Bob. Clare won two more prizes than Anne, but one less than Del. Edmund, who won five prizes, won three more than Bob. Which two children won the same number of prizes?

- Children may enjoy the challenge of creating problems for others to solve using pictures.

Drawing Pictures

Drawing pictures can help solve problems.

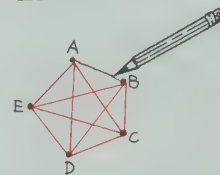
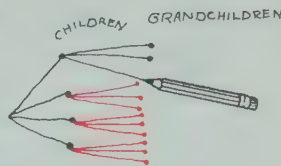
Copy and complete the picture. Then answer the question.

1. Mr. and Mrs. Rogers have 4 children. Each child has 3 children. How many grandchildren in all? *12*

2. How many times do you have to cut a drinking straw to get 10 pieces? *9*

3. When you build a pyramid of 28 blocks, in which row will you put the fifteenth (15th) block you use? *third row from the top*

4. Anne, Bob, and Clare can make a pair 3 ways. How many ways can Anne, Bob, Clare, Del, and Ed make a pair? *10*



Draw pictures to help you answer these questions. *Pictures will vary.*

5. How many pieces do you get if you cut across a pie 3 times? *Answers will vary.*
6. 3 black marbles, 2 white marbles. How many different color patterns can you make with 3 marbles in a row? *7*
7. Anne, Bob, Clare, and Del are standing in line. Bob is the only person between Anne and Clare. Anne and Del are both ahead of Clare. Who is first in line? *Del*
8. Anne, Bob, Clare, and Del are throwing a ball. Anne always throws to Clare. Del and Bob always throw to Anne. Clare takes turns throwing to Del and Bob. Del throws the ball first. After 20 throws, who has the ball? *Clare*
Who made the most throws? *Anne*

PROBLEM SOLVING

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LESSON ACTIVITY

Before Using the Page

- Before the lesson, write the following word problem on the board.

"There are four chairs in a row. In how many ways can two boys and two girls sit in the chairs?"

Read the problem with the children. Explore ways of solving the problem. Then tell the children that drawing pictures often helps people solve problems. Have one child show one way the children can sit on the chairs, for example, G G B B. Then have another child show another way. Continue this until all the ways are represented. Children may enjoy using a row of four chairs to illustrate the different arrangements.

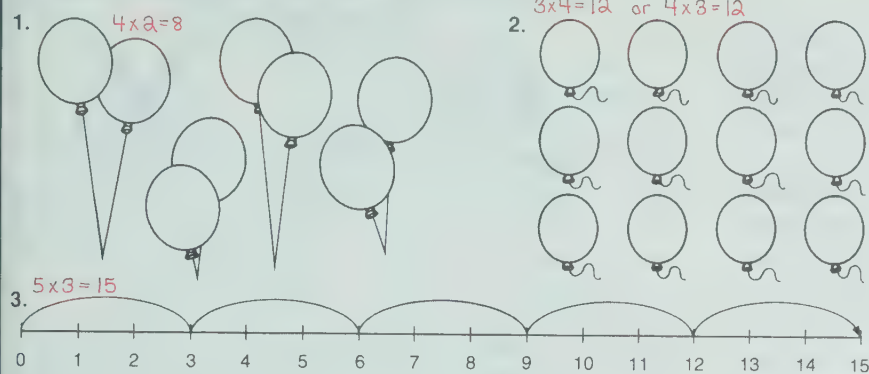
Using the Page

- For Ex. 1-4, discuss the connection between the drawings and the problems. Then have the children copy and complete the drawings and answer the questions in sentences. Children may benefit from a discussion about the shape of the pyramid for Ex. 3. Allow the children to share and explain the pictures they draw to illustrate Ex. 5. Children may require help with the drawings and solutions.

After the children have completed the exercises, discuss how the pictures helped them understand the problems. Encourage children to draw a picture for any problem that seems difficult.

Checking Up

Write a multiplication sentence for each picture.



Draw a picture and write a multiplication sentence for each.

4. 3 groups of 5 $3 \times 5 = 15$
5. an array with 6 rows of 4 $6 \times 4 = 24$ or $4 \times 6 = 24$
6. a number line with 7 jumps of 1 $7 \times 1 = 7$

Write a multiplication sentence to show

7. the product of 5 and 4. $5 \times 4 = 20$ or $4 \times 5 = 20$
8. the product of 6 and 3. $6 \times 3 = 18$ or $3 \times 6 = 18$

Multiply.

9. $8 \times 4 = 32$
10. $3 \times 3 = 9$
11. $9 \times 2 = 18$
12. $0 \times 3 = 0$
13. $5 \times 2 = 10$
14. $1 \times 5 = 5$
15. $4 \times 0 = 0$
16. $7 \times 5 = 35$
17. $6 \times 1 = 6$
18. $4 \times 4 = 16$

Write two multiplication sentences for each array.

19. $2 \times 4 = 8$ or $4 \times 2 = 8$
20. $5 \times 3 = 15$ or $3 \times 5 = 15$

Solve.

21. 3 tickets for each ride on the Ferris Wheel. 7 children want to ride. How many tickets needed? 21
22. 4 cookies in a package. 9 packages. How many cookies in all? 36

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OBJECTIVE

Demonstrate an understanding of the concepts and skills presented in this unit

RELATED ACTIVITIES

- Children may enjoy listing multiplication situations they encounter in everyday life. Use opportunities that naturally arise to demonstrate the use of multiplication.
- Children could review and compare the ways used in Unit 8 to show multiplication, for example, groups of objects, repeated addition, multiplication sentences, number lines, arrays, and pictures. Each child could show one multiplication fact in each of these ways. These could be displayed.
- Although understanding multiplication is the object of Unit 8, it is beneficial for children to begin to learn the products for multiplication facts. Frequent drill is necessary for remembering the products. Games suggested in Unit 8 or riddles such as, "I'm thinking of a number between 15 and 20. Six is a factor of this number. What is the number?" make drill more interesting.

Skills	Exercises	Related Pages
Write a multiplication sentence to describe equal groups	1, 4	T 156-T 157
Write a multiplication sentence to describe an array	2	T 160-T 161
Write a multiplication sentence from a number line	3, 6	T 158-T 159
Write a multiplication sentence for given factors	7, 8	T 160-T 161
Find products	9-18	T 158-T 159 T 162-T 165
Write multiplication sentences for arrays	5, 19, 20	T 168-T 171
Solve multiplication problems	21, 22	

Comments

Difficulties with Ex. 3 may be caused by confusion about how to determine the number of jumps and the number in each jump.

Children may benefit from tracing the jumps on the number line with their fingers and counting each jump.

Unit 8 emphasizes understanding the concept of multiplication. At this stage, it is important that the children understand the meaning of multiplication sentences and understand how to find a product. For Ex. 9-18, encourage the children to draw a picture, a number line, or an array to calculate any product that they do not remember.

If multiplication sentences with zero present difficulties, review multiplying with zero by using concrete materials and illustrations. Then present zero as a factor in different positions, for example, 3×0 and 0×3 .

Children who have difficulty visualizing the remainder of the array for Ex. 20, may require more practice with incomplete arrays. These children may benefit from using graph paper to draw a row and a column as shown by X, completing the array, and then finding the product.



Unit 9 Overview

Exploring Division

This unit explores the operation of division from a number of different aspects so that children may be able to grasp the essential concepts. Division is related to sharing a group of objects, to forming equal groups, to repeated subtraction, and to movement on a number line. The idea of sharing is used as an aid to relate division to various problem situations. Since no remainders are involved at this time, the operation of division is associated with the formation of equal groups from a given number of objects. In some instances the number of groups to be made is known in advance, while in others, the number in each group is known. After the children develop abilities to interpret division situations, arrays are used to investigate the inverse relationship between multiplication and division, and this relationship is then used as an aid for completing division facts.

Prerequisite Skills

- subtract a one-digit number from a one-digit number or a two-digit number
- illustrate subtraction on the number line
- find the product of two factors, to 9×5
- use arrays to show multiplication
- find the missing factor to complete a multiplication sentence

Unit Outcomes

- associate division with forming equal groups; find the number in each group when the number of groups is known (partitive division)
- associate division with finding the number of equal groups; find the number of groups when the number in each group is known (quotitive or measurement division)
- use subtraction to find the number in each group of equal groups; use subtraction to find the number of equal groups
- demonstrate and interpret division concepts
- use the number line to show division and find the quotient
- relate multiplication and division on the number line
- use arrays to relate multiplication and division facts
- use multiplication to divide
- solve problems using a trial-and-error approach

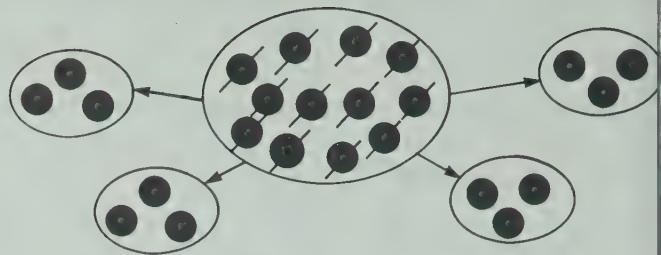
Background

In previous units the operations and uses of addition, subtraction, and multiplication were reviewed and extended. This unit explores the operation of division.

In relation to problem situations, division has two aspects. It is used to find the number in each of several groups and the number of equal groups. A division sentence, for example, $12 \div 4 = 3$, can represent both these concepts. For the first case, 12 objects are shared or *partitioned* into 4 equal groups and it is found that there are 3 objects in each group. For the second case, 12 objects are separated into groups of 4 and it is found that the number of groups is 3. In other words, the 12 is considered in units of 4, or is *measured* in fours.

Partitive (Sharing) Division

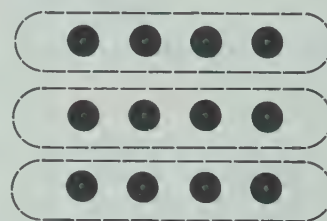
In a sharing situation, the divisor indicates the number of groups, in this case, 4. The 12 objects are shared equally among the 4 groups until all the objects have been shared. The result, called the *quotient*, represents the number in each group.



number of objects in all		number of groups		number each gr
12	\div	4	$=$	3

Quotitive (Measurement) Division

In a measurement situation, the divisor indicates the number in each group. In the number sentence $12 \div 4 = 3$, groups of 4 are removed from the 12 objects until there are no objects left. The quotient 3, represents the number of groups.



number of objects in all		number in each group		number groups
12	\div	4	$=$	3

It is not intended that children should be able to distinguish between these two concepts of division and their subtle differences. It is sufficient that, at this stage, they associate the operation of division with the formation of equal groups.

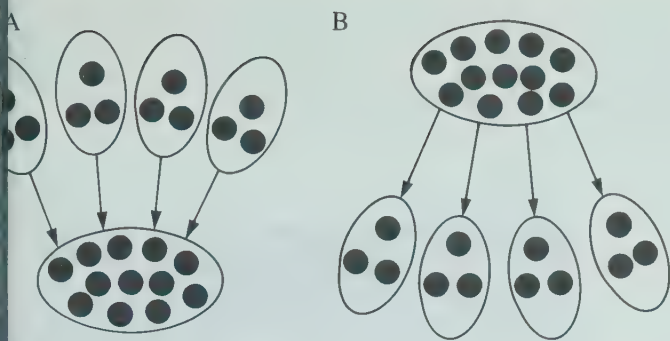
Other approaches to the operation of division support either both of these concepts. In measurement division, repeated subtraction can be used to find the quotient. For $12 \div 4$, for example, the subtractions are

12	8	4
$- 4$	$- 4$	$- 4$
8	4	0

since four objects are removed each time to form a group. The number of subtractions, three, corresponds to the number of groups formed and hence the quotient, 3. The same subtractions support the sharing concept of division. Four objects must be removed each time in order that one object can be placed in each of the four groups. The quotient, 3, corresponds to the number of groups in each group.

Division on a number line involves successive movement backward by the number of units (in other words, measurement) indicated by the divisor. The relationship between division and subtraction is indicated by moving in the same direction on the number line for the two operations.

While it is useful to introduce division through the concrete and conceptual framework of sharing objects, it is also important to consider division in relation to multiplication. In multiplication, equal groups are combined (A); in division, equal groups are formed (B). The diagrams show the inverse relationships involved in $4 \times 3 = 12$ and $12 \div 4 = 3$. What multiplication "does", division "undoes", and vice versa.



Materials

objects for sharing (beads, blocks, counters, buttons)
 objects for set holders (paper plates, boxes, lids)
 counters for each child
 blank cards
 name tags for the first names of children in the class
 demonstration number line (optional); individual number lines
 from copies of page T 359

Vocabulary

division sentence divided by (\div) quotient

The quotient for a division is the missing factor of an incomplete multiplication sentence. Consider the application of the relationship in $32 \div 8 = \underline{\quad}$. This statement will be true only for the number which also makes $8 \times \underline{\quad} = 32$ a true statement. The children's previous experience with multiplication has revealed that the only correct solution is 4 (since $8 \times 4 = 32$). Hence, $32 \div 8 = 4$.

Division with zero can be very confusing. While it is not significant to children at this level, the teacher should be aware that division by zero is meaningless, and that division of zero by a number always results in zero as the quotient. In a measurement interpretation, the incomplete sentence $15 \div 3 = \underline{\quad}$ asks, "How many 3's are in 15?" or "How many times can 3 be subtracted from 15?" It can be seen how meaningless it is to have zero as a divisor if one interprets the number sentence $15 \div 0 = \underline{\quad}$ to mean "How many 0's are in 15?" or "How many times can 0 be subtracted from 15?" On the other hand, zero divided by a number has meaning. The division sentence $0 \div 4 = \underline{\quad}$ can be interpreted to mean "How many 4's are in 0?" or "How many times can 4 be subtracted from 0?" and the obvious answer is 0.

Teaching Strategies

Children should understand the relationship between division and the process of finding both the number in a group and the number of groups. This is particularly important in solving the two basic types of division problems.

As this is the first introduction to division, concrete objects similar to those used in developing the concept of multiplication are recommended both for the children's investigations and for the teacher's demonstrations. Semi-abstract aids such as the demonstration number line and individual number lines are useful. Set holders such as paper plates, boxes, and lids are helpful in developing the two concepts of division. For interpreting division as sharing, the number of groups (set holders) is known. Children can display the required number of set holders and then carry out the sharing process to discover how many objects there will be in each set holder. For interpreting division as measurement, the number in each group (objects) is known. Children can take one set holder at a time and display the required number of objects to discover how many set holders (groups) are required. As has been mentioned previously, manipulative materials and activities should be used as long as children seem to benefit from them.

The last three lessons in the unit show the relationship between multiplication and division. The intent is to prepare the children to draw upon the multiplication facts to solve division problems. In so far as the children may be expected to have mastered the multiplication facts where one factor is five or less, they may be able to reiterate the related division facts. These facts are extended later in Unit 16.

LESSON OUTCOME

Associate division with forming equal groups; find the number in each group when the number of groups is known (partitive division)

Materials

objects for sharing, for example, beads or blocks; blank cards; pencils

Vocabulary

division sentence, divided by, \div

9 EXPLORING DIVISION

Finding the Number in Each Group

Mary, Ben, and Alice share 15 beads.
How many beads does each get?

Each takes 1 . . .

then another . . .

and another . . .

and another . . .

and another . . .

until . . .



Mary, Ben, and Alice each have 5 beads.



15 shared by 3
gives 5 to each.

This can be
shown with the
division sentence

$$15 \div 3 = 5$$

15 divided by 3 equals 5.

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LESSON ACTIVITY

Before Using the Pages

- Have the children in groups of two to five explore the concept of sharing. Provide each group with objects to share equally among themselves. Have one member record the results of the sharing in the following manner:

20 beads shared by 5
gives 4 to each person.

Have the children repeat the procedure with a different number of objects, and then with a different number of children in each group. (Avoid choosing numbers that will involve remainders.) Have a child from each group describe how they shared the objects. Some groups may have each child remove one object from the collection at the same time. For other groups, one child may have removed enough objects each time to give one to each child in the group. Either procedure would continue until all the objects are shared.

Using the Pages

- Have the children compare the sharing situation in photographs on page 162 and the methods of sharing used in the preceding activity. Draw their attention to the statement in the thought cloud at the bottom of the page. Explain how the symbol \div is used in a number sentence called a *division sentence* to describe the sharing. Have the children read the division sentence.

Working Together: The steps presented in Ex. 1-4 represent a sharing process to find the quotient for a division exercise. Complete Ex. 1-4 on the board. For Ex. 2, point out that the sharing is shown by crossing out the circles in the first group as they are shared and drawn in the new groups. For Ex. 4, emphasize the role of each number in the division sentence.

10	\div	2	=	5
number of objects in all		number of groups		number in each group

RELATED ACTIVITIES

- Prepare activity cards similar to the following for children to complete.

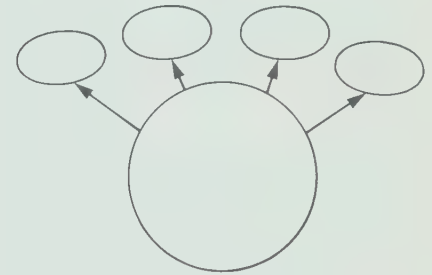
Take 12 blocks.

Share them with a friend.

How many blocks are there for each of you?

Write the division sentence.

- Mark pieces of Bristol board with diagrams similar to the one shown. Children can work individually with counters, buttons, or other small objects to help them complete division exercises provided on flash cards. For example, a board like the one shown would be used to find how many there are in each group for $24 \div 4$. Twenty-four counters would be placed in the large ring and then shared in the four small rings. This particular card can also be used to help children divide other numbers, such as 12, 8, 16, 20, 28, by 4.



Working Together

1. 10 beads to share in 2 equal groups. Copy the picture.

Complete the picture and the division sentence.
2. Show the sharing like this. Complete the picture.

Draw a picture and give the division sentence for each.
3. How many are in each group? 5
4. Complete.
 $10 \div 2 = 5$
5.
 $6 \div 3 = 2$
6. 12 beads shared equally by 3 $12 \div 3 = 4$
7. 24 divided by 4 $24 \div 4 = 6$
8. $16 \div 2 = 8$

Exercises

Complete the division sentence for each picture.

1.
 $8 \div 2 = 4$
2.
 $15 \div 5 = 3$

Complete each picture and the division sentence.

3.
 $9 \div 3 = 3$
4.
 $12 \div 2 = 6$

Draw a picture and write the division sentence for each.

5. $6 \div 2 = 3$
6. $21 \div 3 = 7$
7. $20 \div 4 = 5$
8. $18 \div 3 = 6$
9. $10 \div 5 = 2$
10. $16 \div 4 = 4$
11. $25 \div 5 = 5$
12. $5 \div 5 = 1$

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Children may follow the steps established in Ex. 1-4 to complete Ex. 5-8. Ex. 6-8 review the stages of exploring division as follows: Ex. 6 is an example of sharing equally; in Ex. 7 "divided by" is associated with "shared by"; and the symbol \div is used in Ex. 8 to indicate a division sentence to describe the sharing process.

Exercises: The work with division is exploratory at this time. Understanding the concept is emphasized rather than memorizing facts. Therefore, Ex. 5-12 require diagrams that indicate how children interpret the division. It would be helpful to have children read a division exercise and explain the corresponding sharing process. For Ex. 6, for example, a child might state, "Twenty-one divided by three. I would draw a picture to show twenty-one beads being shared in three equal groups, and then find how many are in each group."

Assessment

Complete the picture and the division sentence.

1.
 $12 \div 3 = 4$

Draw a picture and write the division sentence.

2. $12 \div 2$
 $12 \div 2 = 6$
3. $20 \div 5$
 $20 \div 5 = 4$

LESSON OUTCOME

Use subtraction to find the number in each group when the number of groups is known

Materials

counters for each child

Vocabulary

quotient

Prerequisite Skills

Subtract a one-digit number from a one-digit number or a two-digit number

Checking Prerequisite Skills

Subtract.

$$\begin{array}{r} 1. \quad 9 \\ - 3 \\ \hline 6 \end{array} \quad \begin{array}{r} 2. \quad 30 \\ - 5 \\ \hline 25 \end{array}$$

$$\begin{array}{r} 3. \quad 18 \\ - 2 \\ \hline 16 \end{array} \quad \begin{array}{r} 4. \quad 32 \\ - 4 \\ \hline 28 \end{array}$$

Using Subtraction to Find the Quotient



12 rings.
4 ring boxes.
How many rings
for each box?

To place one ring in each box,
4 rings are needed.

Take 4 rings,
one for each box.

Share 4,
one for each box.

Subtract 4
to keep track.



$$\begin{array}{r} 12 \\ - 4 \\ \hline 8 \end{array} \text{ rings left.}$$

Take 4 rings.

Share 4.

Subtract 4.



$$\begin{array}{r} 8 \\ - 4 \\ \hline 4 \end{array} \text{ rings left.}$$

Take 4 rings.

Share 4.

Subtract 4.



$$\begin{array}{r} 4 \\ - 4 \\ \hline 0 \end{array} \text{ rings left.}$$

There are 3 rings for each box.

There were 3 subtractions.

The result
in a division
is the **quotient**.

$$12 \div 4 = 3$$

3 is
the quotient
in this division.

LESSON ACTIVITY

Before Using the Pages

- Present a division sentence such as $24 \div 4 = \underline{\quad}$. Have one child read the sentence and have another child explain it in terms of sharing. (If 24 beads are shared in four equal groups, how many are in each group?) Ask the children to complete the division. They may draw a picture or use counters. Discuss both of these procedures. Then explain that there is another method for completing a division fact. Tell the children that the other method does not require counters or drawings.

Using the Pages

- The worked example presents the steps for the new procedure of using repeated subtraction beside the steps for the familiar procedure of sharing equally. The dotted rings for each step indicate the rings that were taken and placed in the boxes.

As you guide the children through the example, point out that the difference obtained in a subtraction exercise corresponds to the number of rings left to share. Have the children verify this by counting the colored rings in the group illustrated for each step. Emphasize that when the difference is zero, there are zero rings left to share.

It is important to discuss why the number four is subtracted each time and why the first number it is subtracted from is twelve. Also, emphasize that the final number of rings in each box is the same as the number of subtractions (three).

Read the statements at the bottom of the page to introduce the word *quotient*. If you wish, remind the children that there are words that describe the answers obtained for each of addition, subtraction, and multiplication, and review the words *sum*, *difference*, and *product*. Then review that the quotient for a division can be found by using repeated subtraction and counting the subtractions.

Working Together

15 rings. Each child takes one ring at a time.

- How many rings are taken each time if 3 children are sharing? **3**

Complete the subtraction chain.

$$\begin{array}{r} 15 \\ -3 \\ \hline 12 \end{array} \begin{array}{r} 12 \\ -3 \\ \hline 9 \end{array} \begin{array}{r} 9 \\ -3 \\ \hline 6 \end{array} \begin{array}{r} 6 \\ -3 \\ \hline 3 \end{array} \begin{array}{r} 3 \\ -3 \\ \hline 0 \end{array}$$

- In the chain, what number is subtracted each time? **3**
- In the chain, how many subtractions are there? **5**

Complete these sentences.

- 15 divided by 3 equals **5**
- $15 \div 3 =$ **5**

What number do you subtract each time to find the quotient?

- $20 \div 4 =$ **4**
- $24 \div 3 =$ **3**

Use subtraction to find each quotient. Write the division sentence.

- $20 \div 4 =$ **5**
- $24 \div 3 =$ **8**

Exercises

Use subtraction to find each quotient. Write the division sentence.

- $12 \div 3 =$ **4**
- $8 \div 2 =$ **4**
- $15 \div 5 =$ **3**
- $16 \div 4 =$ **4**
- $32 \div 4 =$ **8**
- $40 \div 5 =$ **8**
- $12 \div 2 =$ **6**
- $5 \div 1 =$ **5**
- $35 \div 5 =$ **7**
- $27 \div 3 =$ **9**
- $30 \div 5 =$ **6**
- $14 \div 2 =$ **7**
- $3 \div 3 =$ **1**
- $24 \div 4 =$ **6**
- $25 \div 5 =$ **5**

Add.

- $\begin{array}{r} 54 \\ + 12 \\ \hline 66 \end{array}$
- $\begin{array}{r} 25 \\ + 48 \\ \hline 73 \end{array}$
- $\begin{array}{r} 574 \\ + 53 \\ \hline 627 \end{array}$
- $\begin{array}{r} 185 \\ + 372 \\ \hline 557 \end{array}$
- $\begin{array}{r} 285 \\ + 337 \\ \hline 622 \end{array}$
- $\begin{array}{r} 324 \\ + 64 \\ \hline 388 \end{array}$
- $\begin{array}{r} 136 \\ + 36 \\ \hline 172 \end{array}$
- $\begin{array}{r} 76 \\ + 24 \\ \hline 100 \end{array}$
- $\begin{array}{r} 286 \\ + 49 \\ \hline 335 \end{array}$
- $\begin{array}{r} 659 \\ + 64 \\ \hline 723 \end{array}$
- $\begin{array}{r} 232 \\ + 245 \\ \hline 477 \end{array}$
- $\begin{array}{r} 157 \\ + 536 \\ \hline 693 \end{array}$

Subtract.

- $\begin{array}{r} 56 \\ - 32 \\ \hline 24 \end{array}$
- $\begin{array}{r} 52 \\ - 46 \\ \hline 6 \end{array}$
- $\begin{array}{r} 695 \\ - 48 \\ \hline 647 \end{array}$
- $\begin{array}{r} 826 \\ - 671 \\ \hline 155 \end{array}$
- $\begin{array}{r} 831 \\ - 258 \\ \hline 573 \end{array}$
- $\begin{array}{r} 467 \\ - 43 \\ \hline 424 \end{array}$
- $\begin{array}{r} 71 \\ - 35 \\ \hline 36 \end{array}$
- $\begin{array}{r} 445 \\ - 84 \\ \hline 361 \end{array}$
- $\begin{array}{r} 200 \\ - 86 \\ \hline 114 \end{array}$
- $\begin{array}{r} 604 \\ - 279 \\ \hline 325 \end{array}$

KEEPING SHARP

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RELATED ACTIVITIES

• Some children may recall that they have met subtraction chains earlier. Have the children turn to page 157 and examine the exercises in *Keeping Sharp*. Review them orally and help the children derive the corresponding division sentences. Some children may wish to write incomplete subtraction chains for other children to complete and write the corresponding division sentences.

• Work sheets similar to the following may be helpful for some children. They must complete the subtraction chains, match the chains with the division exercises, and complete the sentences.

$12 \div 4 =$ 3	$\begin{array}{r} 8 \\ -2 \\ \hline 6 \end{array} \begin{array}{r} 6 \\ -2 \\ \hline 4 \end{array} \begin{array}{r} 4 \\ -2 \\ \hline 2 \end{array} \begin{array}{r} 2 \\ -2 \\ \hline 0 \end{array}$
$8 \div 2 =$ 4	$\begin{array}{r} 15 \\ -5 \\ \hline 10 \end{array} \begin{array}{r} 10 \\ -5 \\ \hline 5 \end{array} \begin{array}{r} 5 \\ -5 \\ \hline 0 \end{array}$
$16 \div 2 =$ 8	

• Print the word *quotient* at the top of a sheet of chart paper. Have children name words that can be formed using the letters of this word. Ask the children to print their words on the sheet. Display the sheet for several days to enable children to add to the list. Some words are *out, in, no, on, it, to, ten, net, tie, toe, not, note, tone, quit, quiet, quite, and quote*.

Working Together: The exercises establish the subtraction chain as a method of finding the quotient in division. Ex. 1-6 show the steps for $15 \div 3$ from a partially completed chain. Ex. 3 and 4 pose significant questions regarding the chain. These questions encourage children to relate the subtraction chain and the sharing procedure. For Ex. 7-10, the children are required to think of most of the steps independently.

Exercises: Give special attention to Ex. 8. There are five subtractions of 1 giving the quotient 5. Although some children may need the reassurance of drawing diagrams or sharing counters, have them show a subtraction chain for each exercise before writing the division sentence.

Keeping Sharp: Determine whether the children's errors are a result of carelessness, poor recall of basic facts, or a lack of understanding the algorithms. Work with children in small groups according to their needs.

Assessment

Use subtraction to find each quotient. Write the division sentence.

- $\begin{array}{r} 10 \\ -5 \\ \hline 5 \\ -5 \\ \hline 0 \end{array}$
 $10 \div 5 = 2$
- $\begin{array}{r} 15 \\ -3 \\ \hline 12 \\ -3 \\ \hline 9 \\ -3 \\ \hline 6 \\ -3 \\ \hline 3 \\ -3 \\ \hline 0 \end{array}$
 $15 \div 3 = 5$
- $\begin{array}{r} 10 \\ -2 \\ \hline 8 \\ -2 \\ \hline 6 \\ -2 \\ \hline 4 \\ -2 \\ \hline 2 \\ -2 \\ \hline 0 \end{array}$
 $10 \div 2 = 5$
- $\begin{array}{r} 28 \\ -4 \\ \hline 24 \\ -4 \\ \hline 20 \\ -4 \\ \hline 16 \\ -4 \\ \hline 12 \\ -4 \\ \hline 8 \\ -4 \\ \hline 4 \\ -4 \\ \hline 0 \end{array}$
 $28 \div 4 = 7$

LESSON OUTCOME

Associate division with finding the number of equal groups; find the number of groups when the number in each group is known (quotitive or measurement division)

Materials

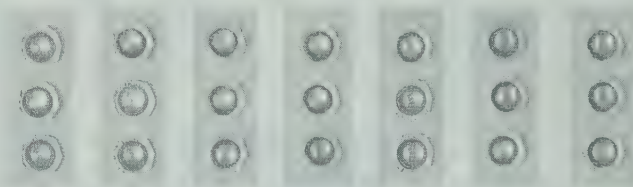
a name tag for the first name of each child, counters for each child

Finding the Number of Groups

Tim needs 21 buttons to form his name.
The buttons are sold with 3 on a card.
How many cards should Tim get?



Think of 21 buttons in groups of 3.



Tim should get 7 cards.

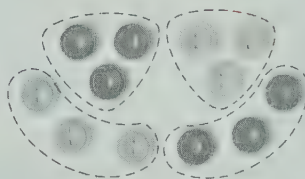
$$21 \div 3 = 7$$

Working Together

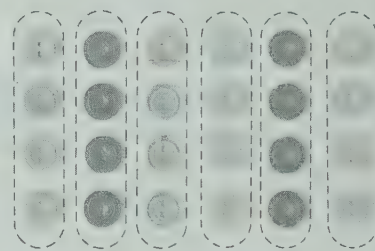
Answer the question and complete the division sentence.

- 12 buttons in groups of 3.
How many groups of 3? 4

$$12 \div 3 = 4$$



2.



24 buttons in groups of 4.
How many groups of 4? 6

$$24 \div 4 = 6$$

3. Draw 16 buttons.
Ring groups of 2.
How many groups of 2? 8

$$16 \div 2 = 8$$

4. Draw 18 buttons.
Ring groups of 3.
How many groups of 3? 6

$$18 \div 3 = 6$$

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LESSON ACTIVITY

Before Using the Pages

- Have each child prepare a name tag for her/his first name.
Display fifteen tags as you tell the children the following story.

There are fifteen children.

To play a game, they must be in groups of three. How can we find out how many groups there will be to play the game?

Lead the children to suggest that they can arrange the name tags in groups of three and then count the number of groups. Have children help arrange the tags and then count the groups. Summarize the situation by stating, "For fifteen children in groups of three, there are five groups."

Repeat the procedure for other numbers of tags. You may wish to have children use their own counters to represent the name tags and find the answer. Then have a child use the name tags to demonstrate the solution.

Using the Pages

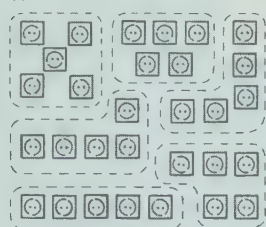
- The worked example illustrates that finding the number groups can be expressed by a division sentence. Discuss how buttons are used to form the letters of a name. Have the children count the buttons used for the name TIM to verify that there are twenty-one buttons. For the buttons on the cards, have the children count by threes to show the seven groups of three equal twenty-one. Then discuss how the division sentence $21 \div 3 = 7$ expresses this relationship.

Working Together: The exercises enable the children to explore division in terms of finding the number of groups. Ex. 1 and 2 present pictures of ringed buttons to show equal groups. Each picture is related to a division sentence. For Ex. 3 and 4, the children are given instructions for drawing their own pictures and determining the quotients from the pictures. Emphasize the significance of each number in the division sentence; that is, the first number tells the number in all, the second number tells the number in each group.

Exercises

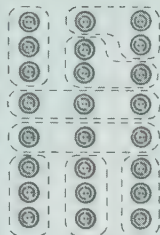
Answer the question and complete the division sentence.

1.



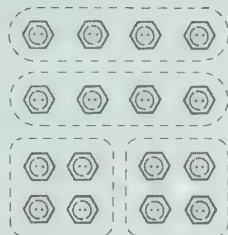
30 buttons. How many groups of 5? $30 \div 5 = 6$

2.



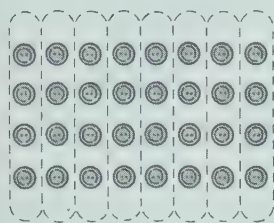
24 buttons. How many groups of 3? $24 \div 3 = 8$

3.



16 buttons. How many groups of 4? $16 \div 4 = 4$

4.



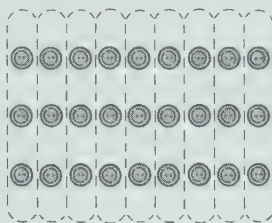
32 buttons. How many groups of 4? $32 \div 4 = 8$

5.



8 buttons. How many groups of 2? $8 \div 2 = 4$

6.



27 buttons. How many groups of 3? $27 \div 3 = 9$

7. Draw 20 ●'s.

Ring groups of 5.

How many groups of 5? $20 \div 5 = 4$

8. Draw 14 ●'s.

Ring groups of 2.

How many groups of 2? $14 \div 2 = 7$

Draw a picture and write the division sentence for each.

- | | | | | |
|---------------------|---------------------|---------------------|---------------------|---------------------|
| 9. $15 \div 5 = 3$ | 10. $9 \div 3 = 3$ | 11. $28 \div 4 = 7$ | 12. $25 \div 5 = 5$ | 13. $10 \div 2 = 5$ |
| 14. $12 \div 4 = 3$ | 15. $12 \div 2 = 6$ | 16. $15 \div 3 = 5$ | 17. $3 \div 1 = 3$ | 18. $8 \div 4 = 2$ |
| 19. $35 \div 5 = 7$ | 20. $20 \div 4 = 5$ | 21. $4 \div 2 = 2$ | 22. $10 \div 5 = 2$ | 23. $40 \div 5 = 8$ |

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RELATED ACTIVITIES

- Prepare cards similar to the following using the first name of each child.

Tom needs 24 buttons to form his name.



The buttons are sold with 4 on a card.

How many cards does Tom need?

$$24 \div 4 = \underline{\quad}$$

Tom needs cards.

- Prepare a work sheet with exercises similar to the ones shown. Have children ring equal groups to help them complete the division sentences.

1.



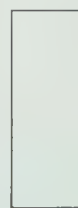
$$16 \div 2 = \underline{\quad}$$

2.

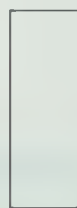


$$12 \div 4 = \underline{\quad}$$

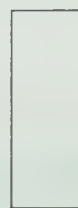
- Prepare cards that show nine rectangles as illustrated. Each child may use counters with one of these cards to help complete a given division sentence. For $14 \div 2$, for example, a child takes fourteen counters, places two counters in the first rectangle, two in the second, and so on until all the counters are used. This would show that seven groups of two are formed.



1



2



3



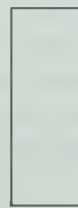
4



5



6



7



8



9

and the quotient tells the number of groups. The children's pictures need not show buttons in a rectangular array as in Ex. 2. Emphasis is placed on ringing the same number of buttons for each group and then counting the groups.

Exercises: For Ex. 1-8, children are given the same instructions as for the exercises in *Working Together*. For Ex. 9-23, the children must think of the steps independently.

Assessment

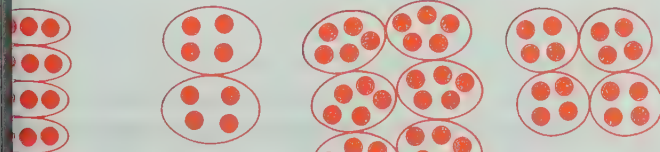
Draw a picture and write the division sentence for each.

$$12 \div 3 = \underline{\quad}$$

$$2. 8 \div 4 = \underline{\quad}$$

$$3. 30 \div 5 = \underline{\quad}$$

$$4. 16 \div 4 = \underline{\quad}$$



$$12 \div 3 = 4$$

$$8 \div 4 = 2$$

$$30 \div 5 = 6$$

$$16 \div 4 = 4$$

LESSON OUTCOME

Use subtraction to find the number of equal groups

Prerequisite Skills

Subtract a one-digit number from a one-digit number or a two-digit number

Checking Prerequisite Skills

Subtract.

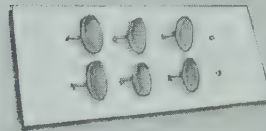
- | | |
|--|--|
| 1. $\begin{array}{r} 8 \\ - 4 \\ \hline 4 \end{array}$ | 2. $\begin{array}{r} 12 \\ - 5 \\ \hline 7 \end{array}$ |
| 3. $\begin{array}{r} 24 \\ - 4 \\ \hline 20 \end{array}$ | 4. $\begin{array}{r} 16 \\ - 2 \\ \hline 14 \end{array}$ |

Using Subtraction to Find The Number of Groups

There are 8 tacks on the card.
2 tacks are used to hold each page.
How many pages can be put up?



Take 2 tacks.



Put up a page.



Subtract 2.

$$\begin{array}{r} 8 \\ - 2 \\ \hline 6 \end{array} \text{ tacks left.}$$

Take 2 tacks.



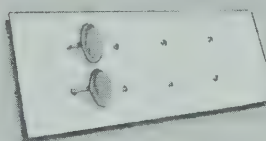
Put up a page.



Subtract 2.

$$\begin{array}{r} 6 \\ - 2 \\ \hline 4 \end{array} \text{ tacks left.}$$

Take 2 tacks.



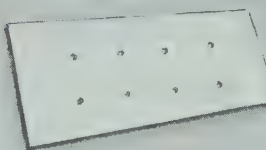
Put up a page.



Subtract 2.

$$\begin{array}{r} 4 \\ - 2 \\ \hline 2 \end{array} \text{ tacks left.}$$

Take 2 tacks.



Put up a page.



Subtract 2.

$$\begin{array}{r} 2 \\ - 2 \\ \hline 0 \end{array} \text{ tacks left.}$$

4 pages can be put up.

There were 4 subtractions.

$$8 \div 2 = 4$$

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LESSON ACTIVITY

Using the Pages

- Remind the children that they learned a way of finding the quotient without using counters or diagrams. Lead them to recall that this method involves subtraction. Then draw their attention to the situation presented in the worked example.

The two ways of finding the number of pages that can be put up are shown side by side. This enables the children to relate them. Discuss the procedure of taking two tacks at a time to hold each page until all the tacks are used. Then review the steps of that procedure. Relate each step to the corresponding subtraction. Ask questions such as:

“Why is two subtracted each time?”

“Why is two subtracted from eight first?”

“How does the subtraction show when there are no more tacks to use?”

“How does subtraction show that four pages can be put up?”

Relate each number of the division sentence $8 \div 2 = 4$ to the original problem.

8	÷	2	=	4
number of objects		number in		number
in all		each group		groups

Working Together: Lead the children through Ex. 1, 3, and 5 on the board. Pay particular attention to Ex. 5 to establish the order of the numbers in the division sentence. Then read Ex. 2, 4, and 6 and have the children write the answers independently. On the basis of their results, provide similar exercises or proceed with Ex. 7 and 8.

Exercises: Some children may need to draw dot diagrams or counters to support the answers obtained by repeated subtraction. Using repeated subtraction to find the number of groups promotes an understanding of the relationship between subtraction and division; that is, the number of subtractions gives the number of groups, and the number of groups names the quotient. This relationship can also be discussed for a few of Ex. 4-24. Have children interpret

Working Together

What number do you subtract each time to find

- 1. how many groups of 5 there are in 15? 5
- 2. how many groups of 2 there are in 12? 6

How many times do you subtract in finding

- 3. how many groups of 5 there are in 15? 3
- 4. how many groups of 2 there are in 12? 6

Give the division sentence that shows

- 5. how many groups of 5 there are in 15. 15 ÷ 5 = 3
- 6. how many groups of 2 there are in 12. 12 ÷ 2 = 6

Use subtraction to find each quotient. Write the division sentence.

- 7. 32 ÷ 4 = 8
- 8. 21 ÷ 3 = 7

Exercises

Use subtraction to answer each question. Write the division sentence.

- 1. How many groups of 4 are there in 24? 24 ÷ 4 = 6
- 2. How many groups of 5 are there in 40? 40 ÷ 5 = 8
- 3. How many groups of 2 are there in 18? 18 ÷ 2 = 9

Use subtraction to find each quotient. Write the division sentence.

- 4. 16 ÷ 4 = 4
- 5. 8 ÷ 4 = 2
- 6. 15 ÷ 3 = 5
- 7. 20 ÷ 5 = 4
- 8. 18 ÷ 3 = 6
- 9. 20 ÷ 4 = 5
- 10. 30 ÷ 5 = 6
- 11. 36 ÷ 4 = 9
- 12. 6 ÷ 3 = 2
- 13. 45 ÷ 5 = 9
- 14. 14 ÷ 2 = 7
- 15. 4 ÷ 4 = 1
- 16. 27 ÷ 3 = 9
- 17. 25 ÷ 5 = 5
- 18. 9 ÷ 3 = 3
- 19. 28 ÷ 4 = 7
- 20. 12 ÷ 3 = 4
- 21. 16 ÷ 2 = 8
- 22. 12 ÷ 4 = 3
- 23. 35 ÷ 5 = 7
- 24. 24 ÷ 3 = 8

Copy and complete these multiplication tables.

1. $\times 2$	2. $\times 3$
1 <u>2</u>	1 <u>3</u>
2 <u>4</u>	2 <u>6</u>
3 <u>6</u>	3 <u>9</u>
4 <u>8</u>	4 <u>12</u>
5 <u>10</u>	5 <u>15</u>
6 <u>12</u>	6 <u>18</u>
7 <u>14</u>	7 <u>21</u>
8 <u>16</u>	8 <u>24</u>
9 <u>18</u>	9 <u>27</u>
3. $\times 4$	4. $\times 5$
1 <u>4</u>	1 <u>5</u>
2 <u>8</u>	2 <u>10</u>
3 <u>12</u>	3 <u>15</u>
4 <u>16</u>	4 <u>20</u>
5 <u>20</u>	5 <u>25</u>
6 <u>24</u>	6 <u>30</u>
7 <u>28</u>	7 <u>35</u>
8 <u>32</u>	8 <u>40</u>
9 <u>36</u>	9 <u>45</u>

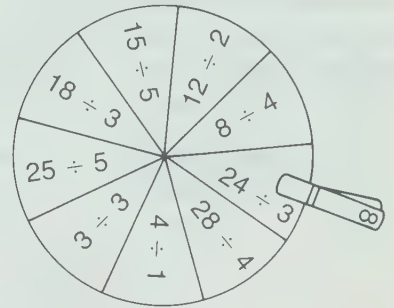
Multiply. Use a table to help you if needed.

- 5. $4 \times 3 = 12$
- 6. $6 \times 5 = 30$
- 7. $9 \times 3 = 27$
- 8. $8 \times 5 = 40$
- 9. $9 \times 4 = 36$
- 10. $8 \times 3 = 24$
- 11. $2 \times 4 = 8$
- 12. $7 \times 4 = 28$
- 13. $5 \times 3 = 15$
- 14. $7 \times 5 = 35$
- 15. $9 \times 5 = 45$
- 16. $6 \times 3 = 18$
- 17. $5 \times 4 = 20$
- 18. $6 \times 4 = 24$



RELATED ACTIVITIES

• Cut a circular shape from cardboard. Divide it into nine equal parts. Print a division exercise in each of the parts as shown. Mark the numerals 1 to 9 on clothespins. Have children use repeated subtraction to find each quotient. For each division fact, have them show the quotient by clipping a clothespin to the corresponding section.



• Children can explore two as a divisor using repeated subtraction. Have them show the subtraction chain for $18 \div 2$ and complete the division sentence $18 \div 2 = \underline{\quad}$.

18	16	14
$- 2$	$- 2$	$- 2$
16	14	12
12	10	8
$- 2$	$- 2$	$- 2$
10	8	6
6	4	2
$- 2$	$- 2$	$- 2$
4	2	0

Ask what exercise would begin the chain for $16 \div 2$. Have them cover the subtraction $18 - 2 = 16$ with one hand and count the subtractions in the chain that begins with $16 - 2 = 14$. Then have them complete the division sentence $16 \div 2 = \underline{\quad}$. Use a similar procedure for the exercises $14 \div 2$, $12 \div 2$, $10 \div 2$, ..., $2 \div 2$. The procedure may be adapted for exploring 3, 4, and 5 as divisors.

exercise in their own words. For example, " $15 \div 3 = 5$ shows that when 15 is divided into groups of 3, there are 5 groups." Or, " $15 \div 3$ asks how many groups of 3 there are in 15."

Keeping Sharp: These exercises review multiplication facts and keep them current while exploring division. (The relationship between the two operations of multiplication and division will be explored later in Unit 9.)

Explain how to complete the tables and how to refer to them, if necessary, when writing the products for Ex. 5-18.

Assessment

subtraction to answer the question. Write the division sentence.

- How many groups of 2 are there in 10? $10 \div 2 = 5$

subtraction to find each quotient. Write the division sentence.

- $2 \div 3 = 4$
- 3. $5 \div 5 = 1$
- 4. $32 \div 4 = 8$

LESSON OUTCOME

Demonstrate and interpret division concepts

Prerequisite Skills

Find the number in each of equal groups; find the number of equal groups

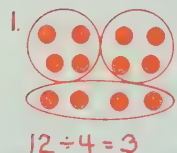
Checking Prerequisite Skills

Draw a picture and write the division sentence for each.

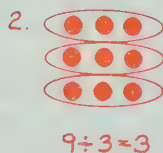
1. $12 \div 4$ 2. $9 \div 3$

Use subtraction to find each quotient. Write the division sentence.

3. $8 \div 2$ 4. $20 \div 4$



$$12 \div 4 = 3$$



$$9 \div 3 = 3$$

3.
$$\begin{array}{r} 8 \\ -2 \\ \hline 6 \\ -2 \\ \hline 4 \\ -2 \\ \hline 2 \\ -2 \\ \hline 0 \end{array}$$

$$8 \div 2 = 4$$

4.
$$\begin{array}{r} 20 \\ -4 \\ \hline 16 \\ -4 \\ \hline 12 \\ -4 \\ \hline 8 \\ -4 \\ \hline 4 \\ -4 \\ \hline 0 \end{array}$$

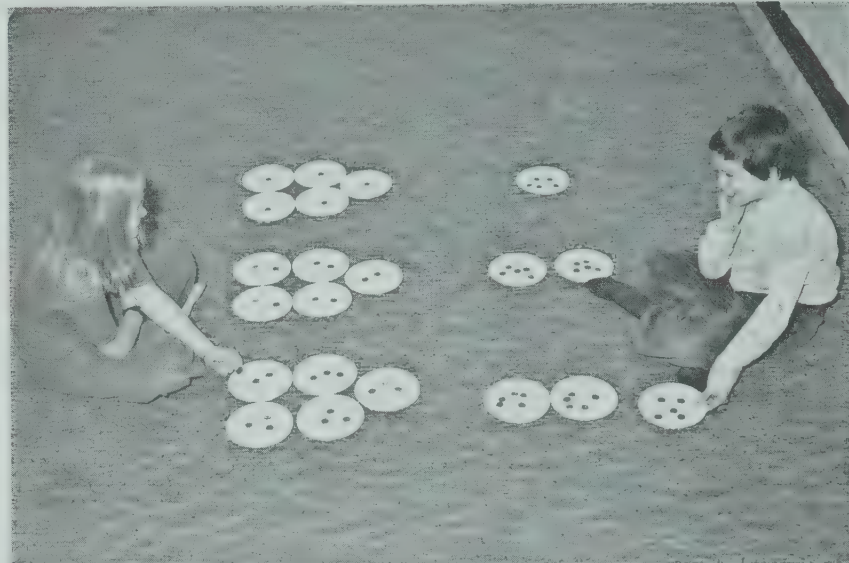
$$20 \div 4 = 5$$

Practicing Division

Paula and Gordon used pennies to show the steps for $15 \div 5$ two ways.

Paula shows the steps for sharing among 5.

Gordon shows the steps for taking groups of 5.



There are 3 in each share.

There are 3 groups.

$$15 \div 5 = 3$$

Another way to find $15 \div 5$ is to subtract 5 at a time.

Paula takes 5 each time and shares.

Gordon takes 5 in a group each time.

$$\begin{array}{r} 15 \\ -5 \\ \hline 10 \end{array} \quad \begin{array}{r} 10 \\ -5 \\ \hline 5 \end{array} \quad \begin{array}{r} 5 \\ -5 \\ \hline 0 \end{array}$$

Paula and Gordon each subtracted 5 3 times. So, $15 \div 5 = 3$

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LESSON ACTIVITY

Using the Pages

- Division has been explored from two points of view:
 - sharing equally and finding how many there are in each share;
 - forming equal groups and finding how many groups there are.

This lesson demonstrates that both of these ways of interpreting division can be shown with one subtraction chain, and therefore, have the same quotient.

Read the statement at the top of the page to introduce the worked example. Guide the children in a discussion of each method.

Paula's method: Paula knew she could set out five plates because for sharing among five, there are five groups. Ask what Paula did not know, but would find out by sharing. (The number of pennies that would be on each plate.) Point out the three sets of plates that show the stages in the

sharing procedure. Then ask how her method shows that the quotient is three.

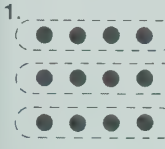
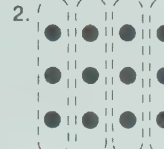


Gordon's method: Gordon knew that for taking groups of five, five pennies are placed on each plate. Ask what Gordon did not know, but would find out by placing five pennies on each plate. (The number of plates that would be used.) Point out the three stages in the grouping procedure. Then ask how his method shows that the quotient is three.

Discuss the subtraction chain as a third way of finding the result of $15 \div 5$. Read the statements at the bottom of the page. Point out how one subtraction chain shows both methods. Suggest that the children may prefer one of the methods and that either method is acceptable.

Working Together: Ex. 1, 2, and 6 present the division $12 \div 4$, and lead the children to find the quotient by grouping (Ex. 1), by sharing (Ex. 2), and by subtraction (Ex. 6). A similar treatment is used for $10 \div 2$ in Ex. 3 and 7. Ex. 5 allows the children to interpret the division $20 \div 5$ according to their preference and encourages them to examine what their picture shows. Have children discuss

Working Together

Answer the question and complete the division sentence.

1.  12 ●'s.
4 ●'s in each group.
How many groups? 3
 $12 \div 4 = 3$
2.  12 ●'s.
4 equal groups.
How many in each group? 3
 $12 \div 4 = 3$
3.  Copy and ring groups of 2. to show 5 groups.
 $10 \div 2 = 5$
4.  Copy and show 2 equal groups.
 $10 \div 2 = 5$
5. Draw a picture of 20 ●'s and show $20 \div 5$.
Does your picture show 5 equal groups or 5 in each group? Either answer is correct.
6. $12 \div 4 = 3$
7. $10 \div 2 = 5$
8. $10 \div 5 = 2$
9. $20 \div 5 = 4$

Exercises

Draw a picture and write the division sentence for each.

1. $25 \div 5 = 5$
2. $27 \div 3 = 9$
3. $35 \div 5 = 7$
4. $12 \div 2 = 6$

Divide. Draw a picture or use subtraction if you need to.

5. $18 \div 3 = 6$
6. $36 \div 4 = 9$
7. $40 \div 5 = 8$
8. $16 \div 4 = 4$
9. $20 \div 4 = 5$
10. $14 \div 2 = 7$

Write the division sentence and answer each question.

11. 8 shoelaces.
2 in each pack. $8 \div 2 = 4$
How many packs? 4
12. 24 snapshots.
4 on each page. $24 \div 4 = 6$
How many pages? 6
13. 18 spice bottles.
2 shelves. $18 \div 2 = 9$
How many bottles for each shelf? 9
14. 6 knobs.
3 drawers. $6 \div 3 = 2$
How many knobs for each drawer? 2

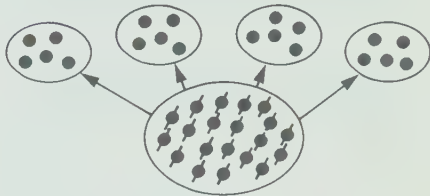
171

RELATED ACTIVITIES

• You may wish to have some children use 15 pennies (or counters) and paper plates to demonstrate the situations shown in the worked example on page 170.

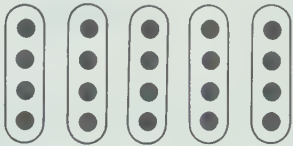
• Children may help prepare a display that shows three ways of thinking of a division fact. For example, a display for $20 \div 4$ would show the following.

1. $20 \div 4$ can mean
20 shared equally by 4.



There are 5 in each share.
 $20 \div 4 = 5$

2. $20 \div 4$ can mean
start with 20; take groups of 4.



There are 5 groups.
 $20 \div 4 = 5$

3. $20 \div 4$ can mean
start with 20; subtract 4's.

20	16	12	8	4
- 4	- 4	- 4	- 4	- 4
16	12	8	4	0

There are 5 subtractions.
 $20 \div 4 = 5$

pictures showing each of these methods. Then have them explain how each picture shows that the quotient is 4. The division $20 \div 5$ is met again in Ex. 9 where repeated subtraction is used.

Exercises: Let children interpret division according to their preference (sharing or grouping) for Ex. 1 and 2. There will likely be children who no longer need to draw pictures or use subtraction to find a quotient. They may be able to think of the procedure or they may remember the division facts. Thus, after Ex. 4, pictures or subtraction chains are optional. Observe the children as they work. Where errors are detected, advise them to draw a picture or to show subtraction.

Word problems involving division are presented in Ex. 11-14. The wording is simple to enable children with weaker reading skills to complete the exercises. Children may draw diagrams or use repeated subtraction for assistance. Ex. 11 and 12 involve forming equal groups. Ex. 13 and 14 involve sharing equally.

Assessment

Divide. Draw a picture or use subtraction if you need to.

1. $8 \div 4 = 2$
2. $16 \div 2 = 8$
3. $21 \div 3 = 7$
4. $20 \div 5 = 4$

LESSON OUTCOME

Use the number line to show division and find the quotient

Materials

demonstration number line (optional), number lines for each child (Copies of page T 359 may be used.)

Prerequisite Skills

Identify subtraction on the number line

Checking Prerequisite Skills

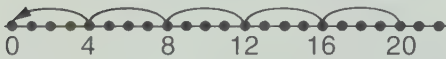
Match each subtraction sentence with the correct number line.

1. $8 - 2 = 6$	
2. $8 - 4 = 4$	
3. $6 - 3 = 3$	
4. $6 - 6 = 0$	

RELATED ACTIVITIES

• If children have prepared a display for division as suggested in the *Related Activities* on page T 187, a number line may be included in the display as described here.

$20 \div 4$ can mean start at 20 and jump by fours to reach 0.

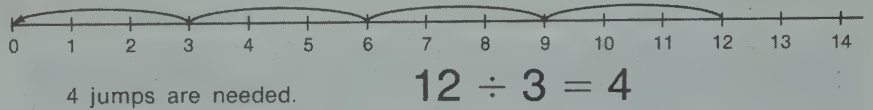


There are 5 jumps.
 $20 \div 4 = 5$

Showing Division on the Number Line

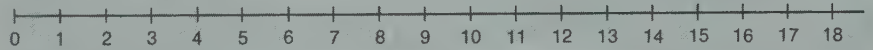
$12 \div 3$ can be shown on the number line.

Start at 12.
Make jumps of 3 and end at 0.



Working Together

Use this number line to help you with the exercises.



Name the starting point, and the size of each jump.

	starting point	size of each jump
1. $8 \div 2$	8	2
2. $15 \div 5$	15	5
3. $18 \div 3$	18	3
4. $5 \div 1$	5	1

How many jumps are needed to reach 0?

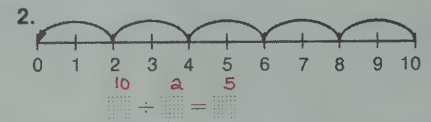
- Start at 12, make jumps of 4. 3
- Start at 9, make jumps of 3. 3

Mark a number line and give the division sentence for each.

- 14 divided by 2 $14 \div 2 = 7$
- $15 \div 3 = 5$

Exercises

Complete the division sentence for each of these.



Mark a number line and write the division sentence for each.

- $6 \div 1 = 6$
- $6 \div 2 = 3$
- $6 \div 3 = 2$
- $6 \div 6 = 1$

Divide. Use a number line if you need to.

- $20 \div 5 = 4$
- $4 \div 4 = 1$
- $4 \div 2 = 2$
- $18 \div 2 = 9$
- $24 \div 4 = 6$
- $24 \div 3 = 8$
- $20 \div 4 = 5$
- $12 \div 2 = 6$
- $21 \div 3 = 7$
- $32 \div 4 = 8$

LESSON ACTIVITY

Using the Page

- Have the children use their fingers to trace the jumps shown on the number line for $12 \div 3$. Emphasize that the starting point is 12, that the jumps are toward zero, and that the size of each jump is 3 units. Ask the children how the number line shows that the quotient is 4.

Working Together: To show division on the number line, children must understand the following aspects.

- The first number in the division fact names the starting point on the number line.
- The second number names the size of each jump.
- Jumps continue until zero is reached.
- The quotient is found by counting the jumps.

These aspects are dealt with in Ex. 1-6. For assistance, children may refer to the number line provided. Give each child number lines for Ex. 7 and 8. (Copies of page T 359

may be used.) For more practice, you may have them show Ex. 1-4 on number lines and then write the division sentences.

Exercises: The four aspects listed under *Working Together* are dealt with in Ex. 1 and 2. Ex. 3-6 not only provide practice in showing division on the number line, but also encourage the children to think about an important aspect of division. For each of these exercises, 6 is the first number, and the second number increases. These exercises may lead to children realizing that as the divisor increases, the quotient decreases. Children may state, "If the jumps on the number line are longer, you don't need as many jumps."

Give each child number lines for Ex. 3-6. Children will require a number line for Ex. 7-16 should be provided with one that extends at least to 32.

Assessment

Mark a number line and write the division sentence for each

- $10 \div 2 = 5$
- $12 \div 4 = 3$
- $18 \div 3 = 6$
- $15 \div 5 = 3$

LESSON OUTCOME

Relate multiplication and division on the number line

Materials

demonstration number line (optional), number lines for each child (Copies of page T 359 may be used.)

Prerequisite Skills

Find the product of two factors, to 9×5

Checking Prerequisite Skills

Multiply.

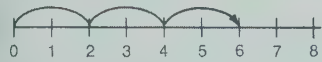
1. $2 \times 3 = 6$ 2. $4 \times 5 = 20$
3. $7 \times 1 = 7$ 4. $9 \times 4 = 36$

RELATED ACTIVITIES

• Have each child prepare a number line for her/his own use from copies of page T 359. (Two or more short number lines may be taped together to make a long line which can be marked to show the numerals.) The lines may be folded and kept in the textbook or notebook when not in use. (A plastic-covered number line is useful. Non-permanent markers may be used so that the marks can be erased before the line is used again.)

Relating Multiplication and Division on the Number Line

To find 3×2 , start at 0 and make 3 jumps of 2.



3 jumps of 2 end at 6.

$$3 \times 2 = 6$$

To find $6 \div 2$, start at 6 and make jumps of 2 back to 0.

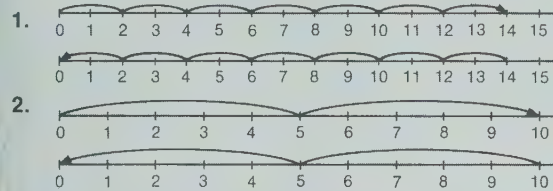


3 jumps are needed.

$$6 \div 2 = 3$$

Working Together

Complete the number sentence for each.



$$7 \times 2 = 14$$

$$14 \div 2 = 7$$

$$2 \times 5 = 10$$

$$10 \div 5 = 2$$

Mark a number line for each and complete the sentence.

3. $6 \times 3 = 18$ 4. $2 \times 4 = 8$ 5. $4 \times 1 = 4$
 $18 \div 3 = 6$ $8 \div 4 = 2$ $4 \div 1 = 4$

Exercises

Mark a number line for each and complete the sentence.

1. $5 \times 3 = 15$ 2. $7 \times 4 = 28$ 3. $2 \times 2 = 4$
 $15 \div 3 = 5$ $28 \div 4 = 7$ $4 \div 2 = 2$

Write the number sentences.

Use a number line if you need to.

4. $8 \times 3 = 24$ 5. $9 \times 5 = 45$ 6. $5 \times 4 = 20$ 7. $8 \times 4 = 32$ 8. $8 \times 2 = 16$
 $24 \div 3 = 8$ $45 \div 5 = 9$ $20 \div 4 = 5$ $32 \div 4 = 8$ $16 \div 2 = 8$

LESSON ACTIVITY

Using the Page

The number line offers a visual approach for exploring the inverse relationship between multiplication and division. For related facts such as $3 \times 2 = 6$ and $6 \div 2 = 3$, one arrow shown on the number line for one fact is the reverse of the arrow shown for the other fact. Review how each operation is shown on the number line in the worked example. Ask questions such as:

“What does the first number in the sentence tell?”

“What does the second number tell?”

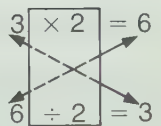
“Where does a multiplication (division) always start (end)?”

“How can you tell what the product (quotient) is?”

Lead the children to observe that the two number lines are the same with the exception of the arrowhead. Comparing the numbers of the two sentences and interpreting them in the following way may help to explain why one arrow is the reverse of the other.

When you start at zero and take 3 jumps of two, you reach 6.

When you start at 6 and jump by twos back to zero, you take 3 jumps.



Working Together: Each exercise deals with a multiplication fact and the related division fact. Having the number line for each division fact below the number line for the related multiplication fact enables the children to compare the arrows showing the related facts. Provide each child with number lines for Ex. 3-5.

Exercises: Provide each child with number lines for Ex. 1-3. Ex. 4-8 encourage the children to complete number sentences for related facts without using a number line.

Assessment

Mark a number line for each and complete the sentence.

1. $4 \times 5 = 20$ 2. $5 \times 3 = 15$
 $20 \div 5 = 4$ $15 \div 3 = 5$

LESSON OUTCOME

Use arrays to relate multiplication and division facts

Materials

counters for each child

Prerequisite Skills

Use arrays to show multiplication

Checking Prerequisite Skills

Match each array with a multiplication fact.

- | | |
|----|---------------------|
| 1. | A $1 \times 3 = 3$ |
| 2. | B $3 \times 2 = 6$ |
| 3. | C $2 \times 5 = 10$ |
| 4. | D $4 \times 4 = 16$ |

Relating Multiplication and Division

An array can be used to show multiplication and division.

3 groups of 4.
12 in all.

$$3 \times 4 = 12$$

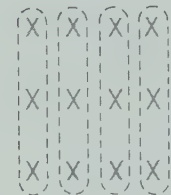


12 divided into 3 groups.
4 in each group.

$$12 \div 3 = 4$$

4 groups of 3.
12 in all.

$$4 \times 3 = 12$$



12 divided into 4 groups.
3 in each group.

$$12 \div 4 = 3$$

The three numbers 3, 4, and 12 give us a family of four multiplication and division facts.

The muffin trays show two arrays with 12 in each array.



1. Show 18 ●'s in two different arrays.

PROBLEM SOLVING

6 by 3 or 3 by 6
2 by 9 or 9 by 2

2. Show 24 ●'s in different arrays.

How many different ways can you show 24 ●'s in an array?⁸
(or 4, if a 4 by 6 array is considered the same as a 6 by 4 array)

2. 1 by 24, 24 by 1, 2 by 12, 12 by 2, 3 by 8, 8 by 3, 4 by 6, 6 by 4

LESSON ACTIVITY

Using the Pages

- The worked example leads children to examine a three by four array first in terms of its rows (three groups of four) and then in terms of its columns (four groups of three). Each way of ringing the groups in the array shows a multiplication and a division sentence. Thus, a family of four multiplication and division facts is derived from one array. Discuss each number sentence and how it relates to the array. Note that the division sentences are considered in terms of the sharing approach. For example, for the first array, $12 \div 3 = 4$ comes from thinking, "Twelve divided into three equal groups gives four in each group." Point out that the same three numbers, 3, 4, and 12, appear in each of the four sentences and that they form a family of facts.

Working Together: Ex. 1 draws attention to the columns of the array and Ex. 2 emphasizes the rows of the array.

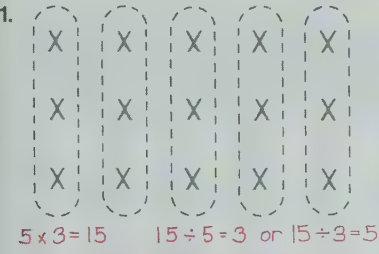
The sentences for Ex. 3 and 4 form one family of facts. Ex. 5 is an example of a family with only two facts. Children may find it easier to draw the array and ring members from the multiplication sentence, and then explain how the array shows the division fact. For Ex. 5, children may draw arrays or use counters.

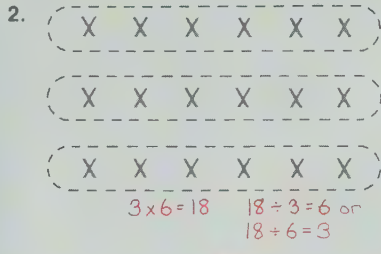
Exercises: The sentences derived from Ex. 1 and 2 form one family of facts. The sentences for Ex. 3 and 4 form a second family. Some children may benefit from drawing arrays or using counters to complete Ex. 5-16.

Problem Solving: Showing different rectangular arrays for one number corresponds to thinking of different pairs of factors that give one product. For example, 24 ●'s can be shown in arrays of 1 by 24 (24 by 1), 2 by 12 (12 by 2), 3 by 8 (8 by 3), and 4 by 6 (6 by 4). Similarly, 24 is the product of each pair of factors 1 and 24, 2 and 12, 3 and 8, 4 and 6. Children may prefer to experiment with different arrays using counters and then copying the arrays on paper.

Working Together

Give a multiplication sentence and a division sentence to match each picture.

1. 
 $5 \times 3 = 15$ $15 \div 5 = 3$ or $15 \div 3 = 5$

2. 
 $3 \times 6 = 18$ $18 \div 3 = 6$ or $18 \div 6 = 3$

$5. 5 \times 2 = 10$
 $2 \times 5 = 10$
 $10 \div 5 = 2$
 $10 \div 2 = 5$

Draw an array and ring its members to show each pair of facts.

3. $14 \div 7 = 2$ 4. $14 \div 2 = 7$ 5. $16 \div 4 = 4$
 $7 \times 2 = 14$ $2 \times 7 = 14$ $4 \times 4 = 16$



6. $7 \times 4 = 28$
 $4 \times 7 = 28$
 $28 \div 7 = 4$
 $28 \div 4 = 7$

Write two multiplication sentences and two division sentences for each group of numbers.

6. 6, 2, 12 7. 7, 3, 21 8. 3, 1, 3
 $6 \times 2 = 12$ $7 \times 3 = 21$ $3 \times 1 = 3$
 $2 \times 6 = 12$ $3 \times 7 = 21$ $1 \times 3 = 3$
 $12 \div 6 = 2$ $21 \div 7 = 3$ $3 \div 3 = 1$
 $12 \div 2 = 6$ $21 \div 3 = 7$ $3 \div 1 = 3$



7. $3 \times 2 = 6$
 $2 \times 3 = 6$
 $6 \div 3 = 2$
 $6 \div 2 = 3$

Exercises

Draw an array and ring its members to show each of these. Write a multiplication sentence and a division sentence to match your picture.

1. 4 groups of 2 ●'s. $4 \times 2 = 8$ 2. 8 in all. 2 groups of 4 ●'s.
8 in all. $8 \div 4 = 2$ or $8 \div 2 = 4$
3. 5 groups of 4 ●'s. $5 \times 4 = 20$ 4. 20 in all. 4 groups of 5 ●'s.
20 in all. $20 \div 5 = 4$ or $20 \div 4 = 5$

$2 \times 4 = 8$
 $8 \div 2 = 4$ or $8 \div 4 = 2$

9. $7 \times 5 = 35$
 $5 \times 7 = 35$
 $35 \div 7 = 5$
 $35 \div 5 = 7$

Write two multiplication sentences and two division sentences for each group of numbers.

5. 5, 2, 10 6. 7, 4, 28 7. 3, 2, 6
8. 9, 5, 45 9. 7, 5, 35 10. 8, 3, 24
11. 9, 2, 18 12. 9, 4, 36 13. 9, 3, 27
14. 6, 4, 24 15. 8, 2, 16 16. 6, 5, 30

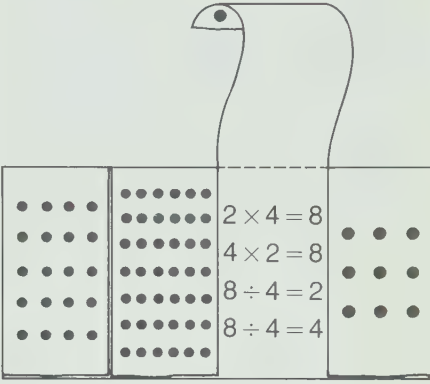
10. $8 \times 3 = 24$
 $3 \times 8 = 24$
 $24 \div 8 = 3$
 $24 \div 3 = 8$

11. $9 \times 2 = 18$
 $2 \times 9 = 18$
 $18 \div 9 = 2$
 $18 \div 2 = 9$

12. $9 \times 4 = 36$ 13. $9 \times 3 = 27$ 14. $6 \times 4 = 24$ 15. $8 \times 2 = 16$ 16. $6 \times 5 = 30$
 $4 \times 9 = 36$ $3 \times 9 = 27$ $4 \times 6 = 24$ $2 \times 8 = 16$ $5 \times 6 = 30$
 $36 \div 9 = 4$ $27 \div 9 = 3$ $24 \div 6 = 4$ $16 \div 8 = 2$ $30 \div 6 = 5$
 $36 \div 4 = 9$ $27 \div 3 = 9$ $24 \div 4 = 6$ $16 \div 2 = 8$ $30 \div 5 = 6$

RELATED ACTIVITIES

• Some children may benefit from using activity sheets similar to the following. Fold a sheet of heavy paper in half. Cut several strips in the upper half as shown, leaving the end of each strip joined at the fold. Cut arrays of dots from copies of page T 366. Paste different arrays on the strips. Under each strip show the corresponding family of facts. Children may write the family of facts for each array and check their answers by lifting the strips.



• Children may practice multiplication facts by playing a game in groups of three or four using two dice, one marked 1, 2, 3, 4, 5, 6 and one marked 4, 5, 6, 7, 8, 9. Players toss the dice in turn and find the product of the numbers shown. For each round, the player (or players) with the greatest product scores one point. At the end of an agreed number of rounds or a given time limit, the player with the highest score is the winner.

Assessment

Write two multiplication sentences and two division sentences for each group of numbers.

1. 3, 7, 21 2. 4, 5, 20 3. 3, 6, 18
 $3 \times 7 = 21$ $4 \times 5 = 20$ $3 \times 6 = 18$
 $7 \times 3 = 21$ $5 \times 4 = 20$ $6 \times 3 = 18$
 $21 \div 3 = 7$ $20 \div 4 = 5$ $18 \div 3 = 6$
 $21 \div 7 = 3$ $20 \div 5 = 4$ $18 \div 6 = 3$

LESSON OUTCOME

Use multiplication to divide

Prerequisite Skills

Find the missing factor to complete a multiplication sentence

Checking Prerequisite Skills

Complete each of the following.

1. $2 \times \underline{5} = 10$
2. $5 \times \underline{3} = 15$
3. $9 \times \underline{4} = 36$
4. $7 \times \underline{2} = 14$

Using Multiplication to Divide

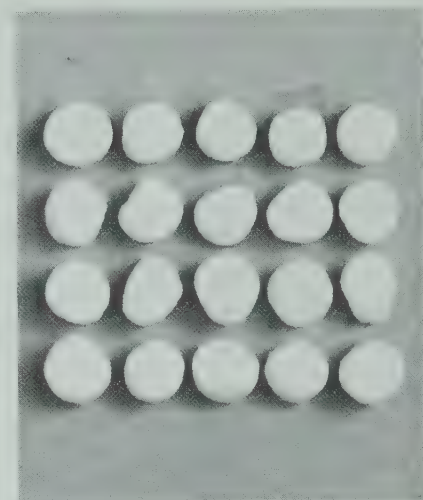
Multiplication facts are useful for finding quotients.

For $20 \div 4$

think

$$\begin{array}{l} 4 \times \boxed{\quad} = 20 \\ 4 \times 5 = 20 \end{array}$$

$$20 \div 4 = 5$$



Working Together

Complete.

- | | | |
|--------------------------------|--------------------------------|--------------------------------|
| 1. For $12 \div 4$, | 2. For $18 \div 2$, | 3. For $21 \div 3$, |
| $4 \times \quad = 12$ <u>3</u> | $2 \times \quad = 18$ <u>9</u> | $3 \times \quad = 21$ <u>7</u> |
| $12 \div 4 =$ <u>3</u> | $18 \div 2 =$ <u>9</u> | $21 \div 3 =$ <u>7</u> |

What multiplication fact can be used to find each quotient?

- | | | |
|--|---|---|
| 4. $18 \div 3$
<u>$3 \times 6 = 18$</u> | 5. $12 \div 2$
<u>$2 \times 6 = 12$</u> | 6. $20 \div 5$
<u>$5 \times 4 = 20$</u> |
| Give a multiplication fact that can be used for each division. | | |
| Give the division sentence. | | |
| 7. <u>$2 \times 7 = 14$</u>
$14 \div 2 = 7$ | 8. <u>$3 \times 5 = 15$</u>
$15 \div 3 = 5$ | 9. <u>$5 \times 2 = 10$</u>
$10 \div 5 = 2$ |

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LESSON ACTIVITY

Before Using the Pages

- To review the previous lesson, write the numbers 3, 5, and 15 on the board. Have children write the four related sentences on the board. If necessary, relate the sentences to the corresponding array.

$$\begin{array}{ll} 3 \times 5 = 15 & 15 \div 3 = 5 \\ 5 \times 3 = 15 & 15 \div 5 = 3 \end{array}$$

Using the Pages

- Draw the children's attention to the array of marshmallows. Ask how many marshmallows there are in the array. Ask for the number of rows and the number of columns. Discuss that the array relates the three numbers, 4, 5, 20, for a family of two multiplication facts and two division facts. Explain that because facts occur in families, multiplication is helpful in finding quotients in division.

Discuss the worked example. Emphasize the multiplication fact in the thought cloud. Note that only one multiplication fact is shown because 4×5 gives the same result as 5×4 .

Working Together: Ex. 1-3 guide the children through the steps in thinking of multiplication to find a quotient. Ex. 4-6 deal with the skill of determining what multiplication sentence is used to find a quotient. Use similar exercises needed before proceeding with Ex. 7-9.

Exercises: You may wish to discuss Ex. 13 before assigning Ex. 13-16. Children must count the toothpicks that are needed to make one shape and use this number in a division sentence. The shapes given for Ex. 13-15 are two-dimensional. The shape for Ex. 16 is three-dimensional.

Try This: Provide the children with toothpicks for experimenting with these problems. Have the children use a trial-and-error approach. (A trial-and-error approach to problem solving is also used in the lesson for page 178.)

Exercises

Write a multiplication fact that can be used for each division. Write the division sentence.

Example: For $6 \div 3$, write

$$3 \times 2 = 6$$

$$6 \div 3 = 2$$

1. $3 \times 3 = 9$
 $9 \div 3 = 3$
 $2 \times 5 = 10$
 $10 \div 2 = 5$
 $5 \times 6 = 30$
 $30 \div 5 = 6$

2. $4 \times 8 = 32$
 $32 \div 4 = 8$
 $2 \times 8 = 16$
 $16 \div 2 = 8$
 $4 \times 9 = 36$
 $36 \div 4 = 9$

3. $5 \times 9 = 45$
 $45 \div 5 = 9$
 $3 \times 9 = 27$
 $27 \div 3 = 9$
 $3 \times 4 = 12$
 $12 \div 3 = 4$

4. $4 \times 7 = 28$
 $28 \div 4 = 7$
 $5 \times 8 = 40$
 $40 \div 5 = 8$
 $4 \times 4 = 16$
 $16 \div 4 = 4$

Divide to solve each problem.

Write the multiplication fact you use.

Molly made shapes with marshmallows and toothpicks.

13. 24 toothpicks.

How many of these did she make? 8
 $3 \times 8 = 24$



14. 24 toothpicks.

How many of these did she make? 6
 $4 \times 6 = 24$



15. 35 toothpicks.

How many of these did she make? 7
 $5 \times 7 = 35$



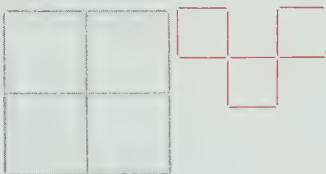
16. 30 toothpicks.

How many of these did she make? 5
 $6 \times 5 = 30$

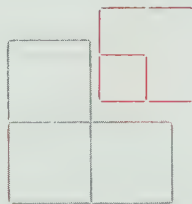


Place toothpicks as shown in each picture. Other answers are possible.

1. Move three toothpicks to make three squares.



2. Move two toothpicks to make two squares.

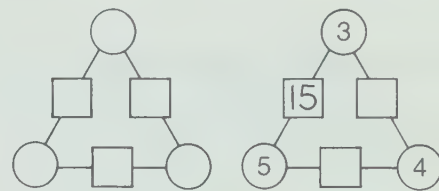


try this

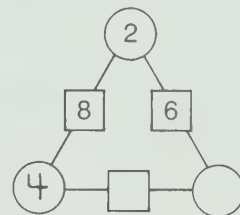
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RELATED ACTIVITIES

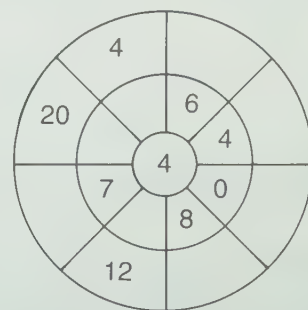
- Make copies of the following diagram. Show one-digit numbers as factors in the circles. Have children show the products in the squares.



- Use copies of the above diagram in the following way. Show a number in one circle. Show two different multiples of this number in the adjoining squares. Have children complete the rest of the diagram. You may wish to have the children write the multiplication and division sentences suggested by each set of three related numbers.



- Prepare a work sheet with number wheels similar to the following. The number in the outer band is the product of the number in the middle band and the number at the center. (Copies of page T 367 may be used.)



Assessment

Write a multiplication fact that can be used for each division. Then write the division sentence.

1. $35 \div 5$ 2. $18 \div 2$ 3. $24 \div 4$

$5 \times 7 = 35$ $2 \times 9 = 18$ $4 \times 6 = 24$
 $35 \div 5 = 7$ $18 \div 2 = 9$ $24 \div 4 = 6$

OBJECTIVE

Solve problems using a trial-and-error approach

RELATED ACTIVITIES

• Some children may enjoy writing "Guess and Test" problems for other children to solve. Examples are provided here.

1. Three numbers in a row have a sum of 36. The numbers are in this list. 10, 11, 12, 13, 14, 15, 16, 17. What are the three numbers?
2. The product of two numbers is 12. The difference of the two numbers is 4. The numbers are in this list. 1, 2, 3, 4, 5, 6, 7, 8, 9. What are the two numbers?
3. The product of two numbers is 24. Their sum is 10. What are the numbers?
4. The sum of two numbers is 12. Their quotient is 2. What are the numbers?

Guess and Test

Guessing, then testing your guesses can help you solve problems.

I am thinking of two numbers that are next to each other on this list. Their sum is 73. What are the two numbers?



26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45

Guess	35 and 36	Guess	37 and 38	Guess	36 and 37
Test	35 + 36 71	Test	37 + 38 75	Test	36 + 37 73
	Too low!		Too high!		

The two numbers are 36 and 37.

Exercises

The answers for each question are on this list. Make guesses, then test your guesses until you solve each problem.

1 2 3 4 5 6 7 8 9

1. The sum of three numbers in a row on the list is 18. What are the three numbers? 5, 6, 7
2. The sum of three different numbers is 23. What are the three numbers? 6, 8, 9
3. The sum of two numbers is 14. Their difference is 4. What are the two numbers? 5, 9
4. The product of two numbers is 24. Their sum is 11. What are the two numbers? 3, 8
5. Bunny had some nickels and dimes. She used 7 of them to buy a notebook for 55¢. How many of each coin did she use? 4 dimes, 3 nickels
6. Sharon bought some 5¢, 4¢, and 2¢ stamps. She paid 30¢ for 10 stamps. How many of each stamp did she buy?
7. 3 kg in each small bag. 5 kg in each large bag. How many of each bag for 22 kg in all?

PROBLEM SOLVING

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6. six 2¢ stamps
two 4¢ stamps
two 5¢ stamps

7. four 3 kg bags
two 5 kg bags

LESSON ACTIVITY

Using the Page

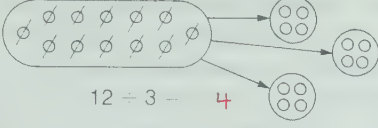
• Many children have their favorite guessing games. Page 178 may be introduced as a mathematical guessing game.


Read the problem presented in the worked example. Remind the children that the two numbers are next to each other in the list. Read and discuss the solution. Point out that three guesses are made. Explain that sometimes it is possible to guess the right numbers the first time and at other times it is necessary to make several guesses. Emphasize, however, that for the solution presented, reasoning also takes place after each incorrect guess. The answers are considered when deciding which numbers to choose next.


Exercises: Ensure that the children understand that the answer to each problem must be found in the list. For example, in Ex. 6, some children may suggest five four-cent stamps and five two-cent stamps as a solution since the amount paid would be thirty cents. In that case, however, Sharon would have bought zero five-cent stamps, but the number zero is not on the list of possible answers. The correct answer is two five-cent stamps, two four-cent stamps, and six two-cent stamps.

Checking Up

Complete the division sentence for each picture.

1.  $12 \div 3 = 4$

2.  $20 \div 4 = 5$

3.  $18 \div 3 = 6$

Draw a picture and write the division sentence for each.

4. 6 beads shared equally by 3
 $6 \div 3 = 2$

5. 10 buttons in groups of 5
 $10 \div 5 = 2$

Mark a number line and write the division sentence for

6. $14 \div 2 = 7$

Complete the division sentence for this subtraction chain.


7. $15 - 5 = 10$
 $10 - 5 = 5$
 $5 - 5 = 0$
 $15 \div 3 = 5$

8. $15 \div 3 = 5$

9. $6 \div 2 = 3$

Use subtraction to find each quotient.

Write a multiplication sentence and a division sentence to match this picture.

10.  $5 \times 2 = 10$
 $10 \div 5 = 2$ or $10 \div 2 = 5$

11. 2, 4, and 8. $2 \times 4 = 8$
 $4 \times 2 = 8$
 $8 \div 2 = 4$
 $8 \div 4 = 2$

Write a multiplication fact that can be used to find the quotient. Write the division sentence.

12. $12 \div 4 = 3$ 13. $35 \div 5 = 7$ 14. $36 \div 4 = 9$

Divide.

15. $30 \div 5 = 6$ 16. $21 \div 3 = 7$ 17. $32 \div 4 = 8$ 18. $18 \div 2 = 9$

Write the division sentence and answer the question.

19. 32 legs. 4 legs for each table. How many tables? $32 \div 4 = 8$

20. 24 chairs in 3 equal rows. How many chairs in each row? $24 \div 3 = 8$

OBJECTIVE

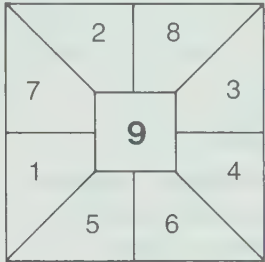
Demonstrate an understanding of the concepts and skills presented in this unit

RELATED ACTIVITIES

• Children may reinforce their work with arrays and division by playing the following adaptation of the game "Lucky Nine".

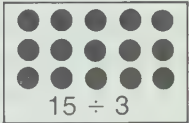
Players: two or three

Materials: a game board as shown below; nine markers for each player; cards that show arrays with division exercises for division facts presented in this unit.



Rules: The array cards are turned face down. The first player turns up an array card and states the corresponding division sentence, for example,

$15 \div 3 = 5$ for



and places a marker on the space for 5 on the game board. If there is a marker on the space for 5 already, the player removes it and places it in her/his pile of markers, instead of placing a marker there. A player who obtains a division fact card for 9 claims all the markers on the game board. The game ends when one player has no more markers. The winner is the player with the most markers.

Skills	Exercises	Related Pages
Complete a division sentence to find the number in each group	1, 4	T 178-T 179
Complete a division sentence to find the number of equal groups	2, 5	T 182-T 183
Complete a division sentence from a number line	3, 6	T 188
Use subtraction to find quotients	7-9	T 180-T 181 T 184-T 185
Use multiplication and division to find quotients	10, 11	T 190-T 191
Use multiplication to divide	12-14	T 192-T 193
Find quotients	15-18	
Solve division problems	19, 20	

Comments

At this stage, children who are having difficulty with division exercises would continue to benefit from working with objects or drawing pictures.

Unit 10 Overview

Geometry and Measurement

Earlier work with measurement paid considerable attention to the concept of length. In this unit, measurement is extended to two dimensions with the study of area, and to three dimensions with the study of volume. Length, is examined from a new point of view which involves the use of different number scales in drawing and interpreting bar graphs.

The remainder of the unit concerns topics in geometry. The study of likenesses and differences begun in Unit 4 now is directed specifically to the properties of size and shape. It is seen that figures that are similar have the same shape but may have different sizes. Whereas Unit 4 dealt with identifying two-dimensional shapes and three-dimensional shapes and examining their properties, this unit investigates the effects of manipulating and moving shapes in certain ways. The motions, which involve flips, turns, and slides, reveal patterns and relationships, as well as properties such as line symmetry. The unit ends with an introduction to coordinate geometry whereby children can name the location of a point in a plane. This leads to the use of a line graph for displaying information.

Prerequisite Skills

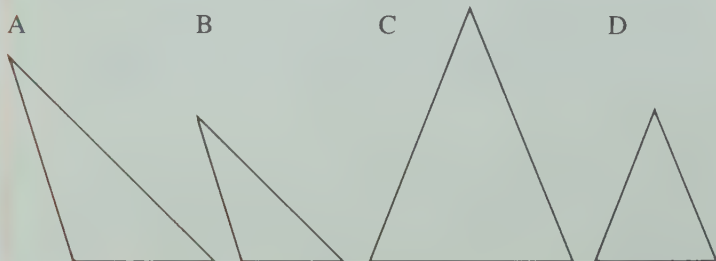
- measure length in centimetres
- recognize like shapes
- interpret bar graphs

Unit Outcomes

- recognize and draw similar shapes
- find area in square centimetres by counting whole units and half units
- find volume in cubic centimetres by counting cubes
- demonstrate an understanding of length, area, and volume
- use bar graphs to show different amounts
- copy and create patterns using slides
- identify and draw shapes having line symmetry
- identify and show lines of symmetry
- create symmetric shapes
- recognize and demonstrate slides, flips, and turns
- match ordered pairs of numbers with positions in an array and with points on a grid

Background

In Unit 4, children examined everyday objects and geometric figures for likenesses and differences. This idea is applied now in an introduction to the concept of *similarity*. In the everyday sense, “similar” figures are those that are “alike”. Mathematically, similar figures can be thought of as those that have the same shape but different sizes. Note that triangular shapes A and B are similar, triangular shapes C and D are similar, but triangular shapes A and C are not similar.



The concept of area is introduced without reference to standard units. In the introductory lesson, children associate finding the area of a region with counting the unit squares covered by that region. A second lesson identifies the area of a unit square as 1 cm^2 (read “one square centimetre”), and this becomes the standard unit for measuring area. Many of the shapes in this lesson involve the addition of two halves of squares for an area of 1 cm^2 . For example, shape E shows whole squares and two halves of squares for a total area of 7 cm^2 .



Volume is associated with counting the unit cubes required to build a shape or occupy a space. The standard unit for measuring volume is the cubic centimetre, seen as a cube whose length, width, and height are each 1 cm. If, for example, 8 such cubes are used to build shape F, the volume of the shape is 8 cm^3 (read “eight cubic centimetres”).

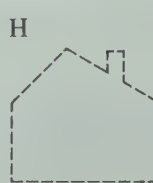
Any shape can be moved to a new position and still retain its original shape, the same dimensions, and occupy the same area. For example, motions such as *slides*, *flips*, and *turns*, can be applied to shapes that are triangular, square, and so on. Such motions are known formally as *transformations*, hence, the term, *transformation geometry* or, informally, *motion geometry*. Although the concept is not new, it is only recently that the value of its study has been recognized. It can be explored effectively through the use of concrete materials. Thus, more emphasis is given to visual and manipulative experiences. Even for very young children, this can lead to an intuitive grasp of many abstract concepts such as congruence, vectors, and line symmetry.

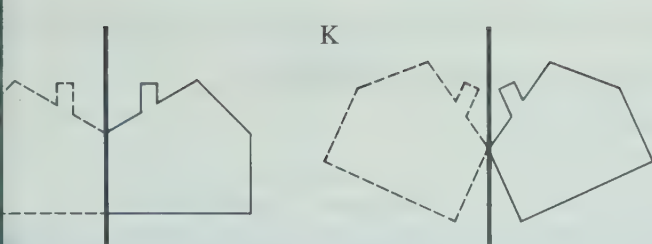
Three basic transformations are explored in this unit, translation (slide), the reflection (flip), and the rotation (turn). The less formal terms shown in parentheses are used at this level since they are more meaningful to children. For the teachers, the benefit of the transformations are discussed in greater detail here. For the children, however, the emphasis is on the action involved and not on a formal development of the concepts.

A shape can slide on a flat surface to the right, to the left, up, down, or diagonally. The slide is always in a straight path (C



A shape can be flipped about a line which may be outside the shape (H), inside the shape (I), or part of the shape (J and K).





shape can turn using any point as a turn center. The turn center may be on the shape or off the shape. At this level only turn centers on the shape are considered, usually at a vertex. The best way to demonstrate this is by putting a pin through a shape and turning the shape about that point.

The effect of a slide, flip, or turn can be noted by comparing the figure in its original position with its *image* (the figure in its new position). Under each of the three motions, the figure and its image are identical in size and shape. Under a slide, the orientation of the shape is not altered. Under a flip, the orientation of the shape is altered. The image appears in a position that is the reverse of the original. Under a turn, the orientation of a figure is changed according to the amount of rotation.

The two topics of flip image and line symmetry are presented in close succession because they tend to support each other. Turning a figure about a line produces a symmetrical figure, and the flip line is the line of symmetry. Similarly, a shape that possesses line symmetry has two matching halves, one on either side of the line of symmetry. Some shapes have more than one line of symmetry. Flips and line symmetry can easily be related to the children's previous experiences with mirrors and mirror images.

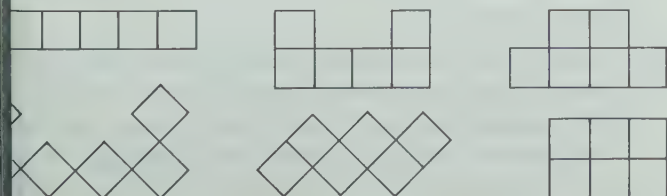
Matching number pairs with points on a grid introduces coordinate geometry. Children use number pairs first to identify positions for objects in an array. The procedure of counting "over" first and then "up" is established in associating positions with number pairs. This same order is used when plotting points on a grid.

Learning Strategies

Much enjoyment and learning can be derived from the use of concrete materials for topics in this unit. Empty containers brought from home by the children can motivate a discussion of similar shapes.

Prior to the work on area, the children may need experiences covering flat surfaces with non-standard units such as playing cards, envelopes, and shapes other than those that are square or rectangular, for example, circles, triangles, pentagons, and hexagons. The activities should be followed by a discussion as to which shapes are more suitable for covering a flat surface and why.

Some children may be challenged to examine the relationship between perimeter and area. Ask, for example, whether shapes that have the same area, such as 6 square units, also have the same perimeter. When it is discovered that the perimeters may differ, have the children determine which of their shapes has the greatest perimeter.



Preliminary activities for the concept of volume include building different shapes using unit cubes and finding the number of unit cubes that are needed to fill a box. Children can estimate the number of cubes required to fill the box and then measure to check. Discussion can involve why objects such as marbles and beads are unsuitable as units of volume. Through activities such as these, children come to associate area with covering a surface and volume with building a shape or occupying space.

Concepts involved in a study of motion geometry can be integrated with other subject areas such as physical education and art. Children can use body motions to demonstrate slides, flips, and turns in the gym. In art lessons, children soon realize that pleasing patterns result from tracing the outline of a shape over and over again as it is moved according to the rules for slides, flips, and turns.

A table arranged in one area of the classroom can display materials such as geoboards, rubber bands, geopaper, Plexiglass mirrors, paper shapes, and paints. In this way children are given an opportunity to discover relationships prior to meeting them formally in a lesson, and to review them afterward.

Bar graphs and line graphs provide ways of displaying information which, at this level, may be related to other subjects and to the children's interests. For example, the outdoor temperature may be shown on a graph at the start of each school day. This procedure reinforces the concept of graphing and helps children become aware of daily temperature changes. Children can recognize the advantages in a visual display of such information as opposed to merely listing the day-to-day temperatures.

In the study of coordinate geometry the concept of order is important. For example, the number pairs (2, 3) and (3, 2) identify different positions on a grid. Care should be taken to ensure that children recognize the significance of the order of the numbers in a number pair. Coordinate graphing can be applied in numerous games that involve naming or guessing the location of a shape in terms of number pairs.

Materials

- straight edge for each child
- objects with similar shapes
- square tiles (ceramic tiles or decimetre squares from copies of page T 362)
- 18 centimetre cubes for each child
- a square, a cube; other cubes (optional)
- tracing paper and cardboard for each child
- geoboards and rubber bands, demonstration clock
- objects or pictures of objects having line symmetry
- copies of pages T 360, T 365, and T 366 for each child
- a triangle identical to the triangle at the top of page 194 for each child
- shapes identical to the shapes in *Working Together* on page 195 for each child (optional)

Vocabulary

- | | |
|-------------------|--------------------------------------|
| similar | square centimetre (cm ²) |
| area, region | cubic centimetre (cm ³) |
| volume, units | symmetric shapes |
| line symmetry | bar graph |
| line of symmetry | line graph |
| slide, flip, turn | grid |

LESSON OUTCOME

Recognize and draw similar shapes

Materials

a straight edge and a copy of pages T 360 and T 365 for each child, objects with similar shapes

Vocabulary

similar

Prerequisite Skills

Recognize like shapes

Checking Prerequisite Skills

Write "same shape" or "different shapes" for each pair of shapes.

1.



same shape

2.



different shapes

3.



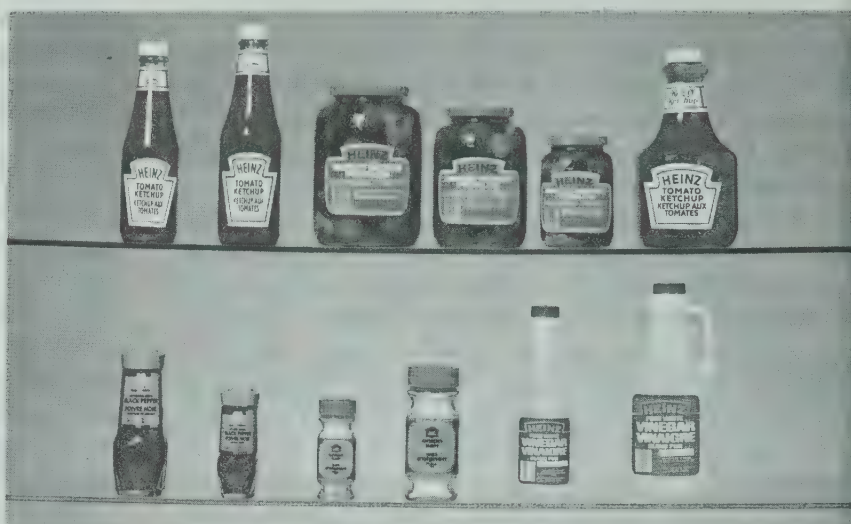
same shape

10 GEOMETRY AND MEASUREMENT

Similar Shapes

The pickle jars have the same shape. They are **similar**.

The vinegar bottles have different shapes. They are not similar.



Working Together

Find each of these on the shelves. Are they similar?

1. two jars of onion salt **yes**

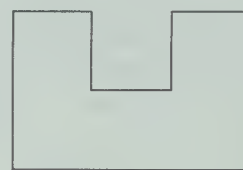
2. three ketchup bottles **no**

Draw a picture

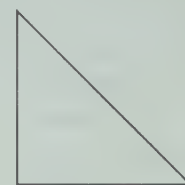
3. similar to, but larger than this shape.



4. similar to, but smaller than this shape.



5. similar to, and the same size as this shape.



LESSON ACTIVITY

Before Using the Pages

- Display two objects with the same shape, for example, similar attribute blocks of different sizes. Ask for the ways the objects are the same and for the ways they are different. Establish that they have the same shape. Have the children find examples of objects having the same shape.

Using the Pages

- Ask for the ways the pickle jars are alike and the ways they are different. Develop that the pickle jars are different sizes, but that they are the same shape. Read the information at the top of the page about the pickle jars to introduce the word *similar*. Point out that *similar* refers to the shape of the objects only.

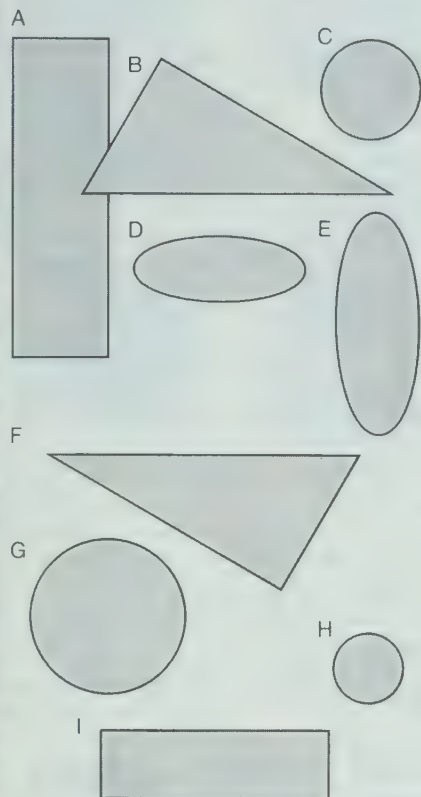
Then read the information about the vinegar bottles. Discuss why they are not similar. Lead the children to suggest that since the vinegar bottles have different shapes,

they are not similar. Ask the children whether the pepper jars are similar. Lead the children to realize that the pepper jars are similar because they have the same shape.

Working Together: Discuss Ex. 1 and 2. Have the children explain how two of the ketchup bottles are similar, but other ketchup bottles are not similar to either of them. The objective for Ex. 3-5 is that the children draw shapes that are roughly similar to show that they understand the concept. Their drawings are not expected to be accurate. The children may enjoy discussing their drawings for Ex. 3-5. For Ex. 3, point out that although the children's drawings may differ in size, they are all to be larger than the shape on the page. Similarly, for Ex. 4, the drawings can be different sizes, but they are to be smaller than the given shape.

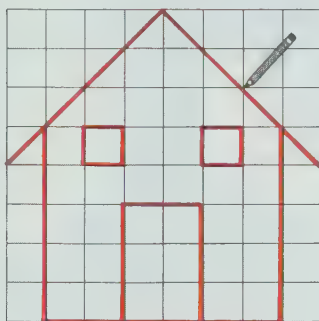
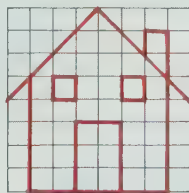
Exercises: Have the children discuss the reasons for their answers. Encourage them to use the word *similar* in their explanations. Point out that different answers are correct. The children may enjoy sharing their drawings for Ex. 3 and comparing the sizes they chose to draw the shapes.

- Exercises**
1. Any four of these pairs are correct.
- A, I
B, F
D, E
C, G
G, H
C, H
2. Name four pairs that are similar.
3. Name two shapes that are similar and the same size. B, F
4. Name two shapes that are not similar. Answers will vary.
5. Draw a picture larger than but similar to Shape B.



Use grid paper with large squares.

1. Copy square by square to make a house similar to each of these.



2. Draw a picture on grid paper. Have a friend copy the picture onto grid paper that has squares of a different size.

try this

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RELATED ACTIVITIES

- Set up a table and a display board to show the children's art, lists, and work sheets for each lesson in this unit. Leave materials for previous lessons and for subsequent lessons in the unit on the table. This gives the children an opportunity to explore for review or for discovery.
- Provide magazines or catalogs for the children to find examples of similar objects for the display. For example, a product advertised in different magazines may be shown in the same shape, but different sizes. Or children may find a shape and draw a similar shape. The two shapes may be displayed together on the board.
- To relate this lesson to the children's environment, have them make a list of similar shapes, for example, buildings in their neighborhood or containers in a grocery store.
- You can prepare work sheets for the children to find similar shapes and color them the same color.
- Draw the outline of a shape formed from tangram pieces. Have the children use tangram pieces from page T368 to make an identical shape.

This: Supply each child with a copy of pages T360 and T365. For Ex. 1, discuss how the two houses are similar. The children may enjoy the challenge of discovering the part of one house that is incomplete. Ask the following questions for each drawing.

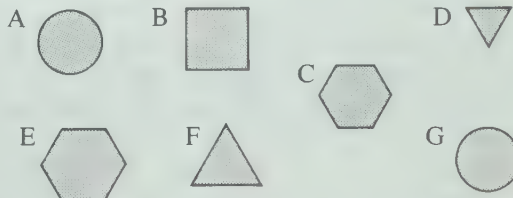
"How many squares are shown?"

"How many squares make up the door?"

Point out that the answers are the same for the two houses. Have the children trace the outlines of the two houses with their fingers and compare the shapes. When they draw their houses, encourage them to match each square with the drawings on the page. Pairs of similar drawings for Ex. 2 would make interesting displays.

Assessment

1. Name two shapes that are similar. A and G, C and E, D and F
2. Name two shapes that are similar and the same size. A and G



LESSON OUTCOME

Find area by counting squares

Materials

a copy of page T 365 for each child for Ex. 7-13; square tiles (floor tiles, ceiling tiles, bathroom tiles or decimetre squares from page T 362)

Vocabulary

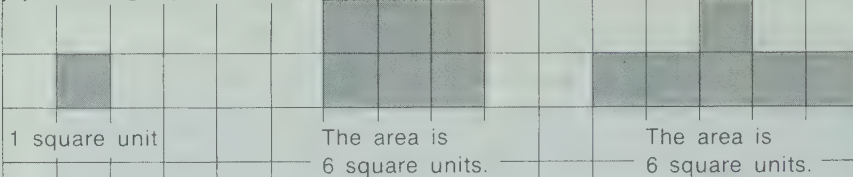
area, region, units

RELATED ACTIVITIES

- Encourage children to be aware of places where tiles can be used to find the area of a region. Kitchen floors, bathroom tiles, and tiled ceilings in the children's homes or in magazine pictures are examples.
- Prepare a work sheet asking children to find and record the area of objects in the classroom. They can use tiles or decimetre squares from page T 362. Emphasize recording *square units* for each area.
- Squares can be used for the game "Show Me". One child states, "Show me a region that has an area of six square units."
- Adapt the listing activity on page T 158 and have the children list objects for which they may wish to find the area.

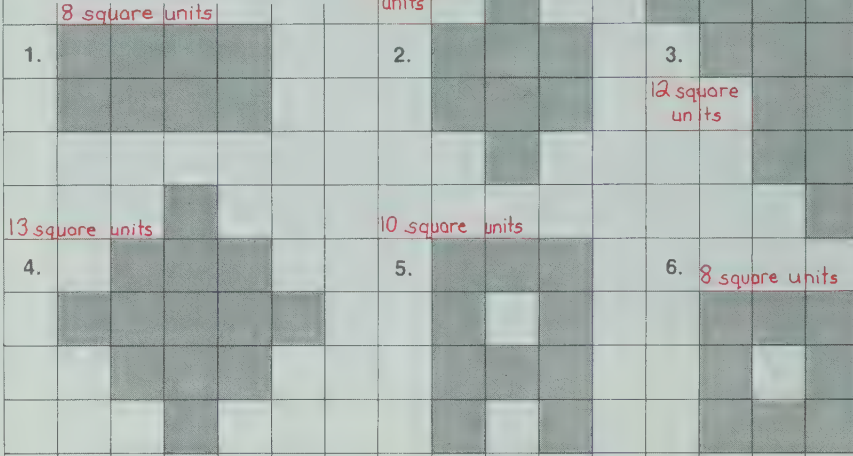
Finding Area

You can find the **area** of a region by counting square units.



Exercises

Find the area of each region.



Use grid paper.

Draw regions with these areas.

7. 9 square units 8. 18 square units 9. 24 square units

Use grid paper. Draw

10. two different shapes that have equal areas. 11. two similar shapes that have different areas.
12. two different rectangles with 12 square units of area for each. *13. a triangle with 2 square units of area.

Answers will vary.

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OUR LADY OF FATIMA SCHOOL
9825 - 153RD STREET
EDMONTON, ALBERTA

LESSON ACTIVITY

Before Using the Page

- Have the children cover their desks (or tables) with tiles. Ask for the number of tiles used to cover a desk. Then tell each child to make a shape with eight tiles. Have them compare their shapes. Develop that different shapes can be made with any number of squares greater than two.

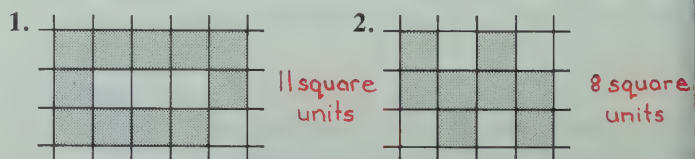
Using the Page

- Read the information at the top of the page. Introduce the term *area* by referring to the area of the children's desks. Have the children explain the meaning of *area*, *region*, and *units* in their own words. Discuss the fact that square units are best for measuring area because they fit well together. Lead the children to suggest that area means the number of squares covering a region. Have the children compare the two regions with areas of six square units.

Exercises: For Ex. 1-6, have the children point to each square they count to find the area. Provide each child with a copy of page T 365 for Ex. 7-13. Children may enjoy sharing their drawings for Ex. 7-13 and comparing the different shapes that have the same area. Some children may benefit from a discussion of Ex. 10-13. Ex. 11 reviews similar shapes. Ex. 12 and 13 review geometric shapes from Unit 4. Encourage children to experiment when drawing the shapes for Ex. 13, which is starred because it involves pairs of squares.

Assessment

Find the area of each shaded region.



3. Use grid paper. Draw two regions each having 5 square units of area.

Answers will vary.

Area in Square Centimetres

The area of this unit is 1 square centimetre.

1 cm²

Two halves of a square centimetre make 1 square centimetre.

The area of this region is 7 square centimetres.

7 cm²

Exercises

Find the area of each region in square centimetres.

1. 9 cm²

2. 7 cm²

3. 6 cm²

4. 7 cm²

Which of these regions have the same area?

5. (a)

b.

c.

(d)

Use square centimetre grid paper.
Draw regions with these areas.

6. 4 cm²

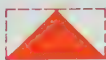
7. 12 cm²

8. 17 cm²

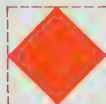
9. 32 cm²

Draw

*10. a triangle with area 1 cm².



*11. a square with area 2 cm².



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LESSON OUTCOME

Find area in square centimetres by counting whole units and half units

Materials

a copy of page T 365 for each child for Ex. 6-11

Vocabulary

square centimetre, cm²

Prerequisite Skills

Find area by counting squares

Checking Prerequisite Skills

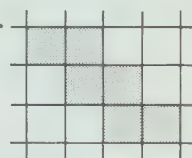
Find the area of each shaded region.

1.



7 square units

2.



6 square units

RELATED ACTIVITIES

• Children may create a shape with tangram pieces from page T 368. Then they can trace the shape on a copy of page T 365, color the region, and find the area. They may be interested in discovering that different shapes made with the same pieces have the same area.

LESSON ACTIVITY

Using the Page

Lead the statement about a *square centimetre*. Ask the children why they think the top red square is called one *square centimetre*. Lead the children to realize that the length of each side of the shape is 1 cm and that the shape is a square. Tell the children that the symbol for one square centimetre is 1 cm². Emphasize the size and the position of the 2.

Tell the children that some shapes do not show only whole squares. (They may have observed this for Ex. 13 on page 182.) Draw the children's attention to the statement and illustration about the halves of a square centimetre. Have children explain the statement.

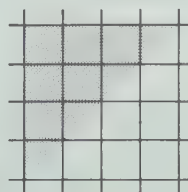
Have the children point to each square as they count the seven square centimetres for the third example. Point out how the two halves in this region make 1 cm².

Exercises: Some children may require help with the symbol for Ex. 1-4. Encourage children to include regions with halves of square centimetres for Ex. 6-9. Emphasize that there must be an even number of half squares in order to make whole squares. Encourage children to draw the shapes for Ex. 10 and 11 by trial and error. For Ex. 10 and 11, children are not expected to prove that the shapes they draw meet the conditions. Children may enjoy sharing their drawings for Ex. 6-11 and comparing the shapes they drew.

Assessment

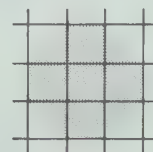
Find the area of each shaded region in square centimetres.

1.



8 cm²

2.



7 cm²

LESSON OUTCOME

Find volume by counting cubic centimetres

Materials

18 centimetre cubes for each child, a square, a cube

Vocabulary

volume, cubic centimetre, cm^3

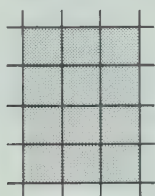
Prerequisite Skills

Find area by counting square centimetres

Checking Prerequisite Skills

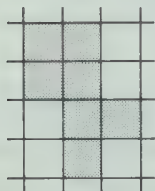
Find the area of each shaded region.

1.



12 cm^2

2.



7 cm^2

Volume

Length is measured with a unit like this

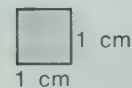
1 centimetre



1 cm

Area is measured with a unit like this

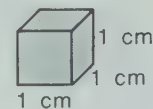
1 square centimetre



1 cm^2

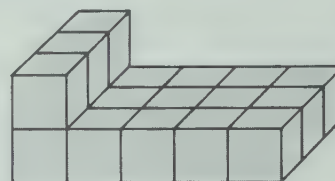
Volume is measured with a unit like this

1 cubic centimetre



1 cm^3

You can find volume by counting cubic centimetres.



18 cm^3

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LESSON ACTIVITY

Before Using the Pages

- Display a square and a cube. Ask the children for ways they are alike and ways they are different.

Using the Pages

- Read the statement about length. Refer to the illustration of 1 cm. Ask:
 “How long is it?”
 Develop that length measures one dimension.
 Read the information about area. Refer to the illustration of 1 cm^2 . Ask:
 “How long is it?”
 “How wide is it?”
 Point out that area involves length and width — two dimensions. Then review the symbol 1 cm^2 .
 Read the statement introducing *volume*. Have the children express the meaning of volume in their own

words. Introduce the term *cubic centimetre*. Comparing the word *cubic* with the solid called a cube may help children learn the new vocabulary. Refer to the illustration of 1 cm^3 . Ask:

“How long is it?”

“How wide is it?”

“How high is it?”

Introduce the symbol cm^3 . Point out that volume involves length, width, and height — three dimensions. Point out the size and the position of the 3.

- Read the statement about finding volume. Compare the method for finding volume and the method for finding area.
 Have the children point to each cube as they count to check the volume of 18 cm^3 . Discuss that some of the cubes are hidden from view. Emphasize that without the hidden cubes, the structure would fall. Have the children build a structure similar to the one on the page. Discuss the positions of the hidden cubes.

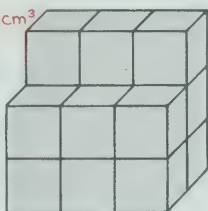
Working Together

Find the volume in cubic centimetres.

1. 12 cm^3



2. 15 cm^3



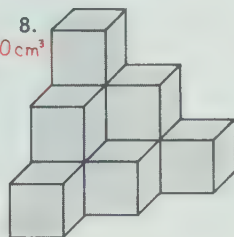
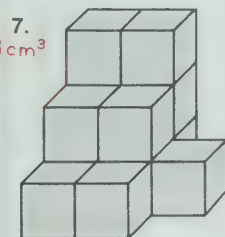
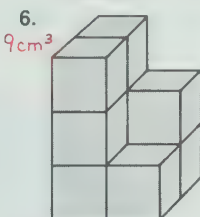
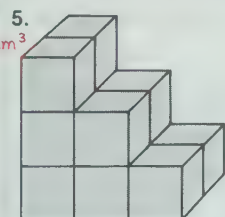
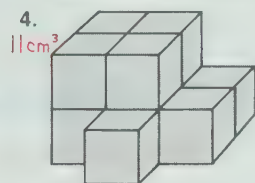
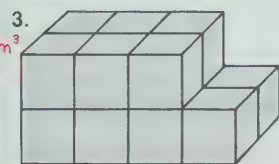
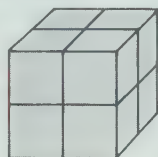
Exercises

Find the volume in cubic centimetres.

1. 6 cm^3



2. 8 cm^3



Multiply.

1. $3 \times 2 = 6$
2. $2 \times 5 = 10$
3. $4 \times 2 = 8$
4. $2 \times 2 = 4$
5. $5 \times 1 = 5$
6. $3 \times 4 = 12$
7. $6 \times 4 = 24$
8. $7 \times 0 = 0$
9. $3 \times 5 = 15$
10. $2 \times 3 = 6$
11. $5 \times 2 = 10$
12. $7 \times 2 = 14$
13. $0 \times 3 = 0$
14. $6 \times 3 = 18$
15. $3 \times 1 = 3$
16. $5 \times 4 = 20$
17. $5 \times 5 = 25$
18. $4 \times 3 = 12$
19. $3 \times 3 = 9$
20. $6 \times 2 = 12$
21. $4 \times 4 = 16$
22. $8 \times 4 = 32$
23. $1 \times 4 = 4$
24. $8 \times 5 = 40$
25. $9 \times 2 = 18$
26. $7 \times 5 = 35$
27. $4 \times 5 = 20$
28. $8 \times 2 = 16$

Divide.

29. $8 \div 4 = 2$
30. $6 \div 2 = 3$
31. $10 \div 5 = 2$
32. $15 \div 3 = 5$
33. $3 \div 3 = 1$
34. $45 \div 5 = 9$
35. $24 \div 4 = 6$
36. $5 \div 1 = 5$
37. $6 \div 3 = 2$
38. $21 \div 3 = 7$
39. $32 \div 4 = 8$
40. $12 \div 2 = 6$
41. $16 \div 4 = 4$
42. $8 \div 1 = 8$
43. $12 \div 3 = 4$
44. $4 \div 4 = 1$
45. $12 \div 4 = 3$
46. $30 \div 5 = 6$
47. $36 \div 4 = 9$
48. $35 \div 5 = 7$
49. $15 \div 5 = 3$
50. $10 \div 2 = 5$
51. $24 \div 3 = 8$
52. $14 \div 2 = 7$
53. $25 \div 5 = 5$
54. $27 \div 3 = 9$
55. $16 \div 2 = 8$
56. $18 \div 3 = 6$

KEEPING SHARP

185

RELATED ACTIVITIES

- Have children build the shapes on page 185 or create shapes of their own with centimetre cubes. Then have them find the volume of each.
- Children may enjoy making centimetre cubes from plasticine or from a pattern and construction paper. Or they can make cubes of a different size using the pattern on page T357. Children may be interested in building a similar shape the same size with centimetre cubes and counting to find the volume.
- You may prepare plans for shapes on squares cut from copies of page T365 as shown. Have children build a shape by placing on each square the number of cubes indicated. Then have them find the volume.
- Have children fill boxes of different sizes with centimetre cubes and then count the number of cubes. If the boxes are labeled, children can record their discoveries for later comparison and checking.
- Children may record which of two boxes they think holds more centimetre cubes and then fill each box to check.

3	1	1
2	0	4
2	5	3

Working Together: For Ex. 1, have each child build the shapes and point to the cubes as they count them. Have each child compare her/his shape with the one in the book. Then have the children point to each cubic centimetre in the drawing as they count to find the volume. Use a similar procedure for Ex. 2, emphasizing that some of the cubes are hidden. Provide similar examples if necessary.

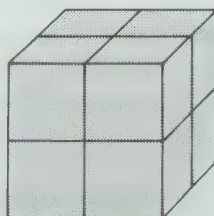
Exercises: Some children may need to build the structures in order to understand the positions of hidden cubes. Encourage children to try finding the volume from the drawings and, if necessary, checking the answers with centimetre cubes.

Keeping Sharp: These exercises review multiplication and division facts. Although the children should remember some of the products and quotients, the emphasis is still on understanding the concept. Remind the children to use methods from Units 8 and 9 to complete the facts they do not remember.

Assessment

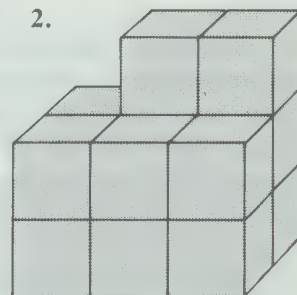
Find the volume in cubic centimetres.

1.



8 cm^3

2.



14 cm^3

OBJECTIVE

Demonstrate an understanding of length, area, and volume

Materials

cubes (optional for *Try This*)

RELATED ACTIVITIES

- Adapt the listing activity on page T 158 and have the children list occasions for measuring each of length, area, and volume. These lists could be placed on the display for Unit 10.
- Children may prepare a chart similar to the chart on page 186. Each child could complete the answers for her/his own chart or children could trade charts and complete a chart prepared by a friend.
- Children may enjoy building shapes similar to the one for *Try This*. Have them record what they think the volume of each is and then count the cubes to check.

Practice

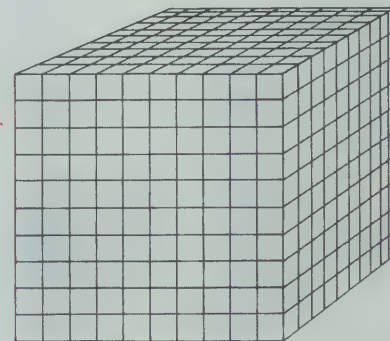
Copy the chart. Use a check to show whether you would measure length, area, or volume.

1. How tall are you?
2. How big is the blanket?
3. How much will the box hold?
4. Will the blocks fit in the bag?
5. Will the dictionary fit between the other books on the shelf?
6. How much wall is there to paint?
7. Can you walk through the door of the playhouse without bumping your head?
8. Is the closet large enough to hold all the cartons?
9. How much of the floor is covered by the rug?

	Length	Area	Volume
1.	✓		
2.		✓	
3.			✓
4.			✓
5.	✓		
6.		✓	
7.	✓		
8.			✓
9.		✓	

Each little block is 1 cm³.

1. What is the length of one edge of the large block? 10 cm
2. What is the area of one face of the large block? 100 cm²
3. What is the volume of the large block? 1000 cm³



186

LESSON ACTIVITY

Using the Page

- Read the instructions. Discuss the reasons for the answer for Ex. 1. Review the meaning of length, area, and volume. Children may benefit from discussing the following equipment for measuring. If a string can be used for measuring, length is being measured. If a square can be used, area is being measured. If a cube can be used, volume is being measured.

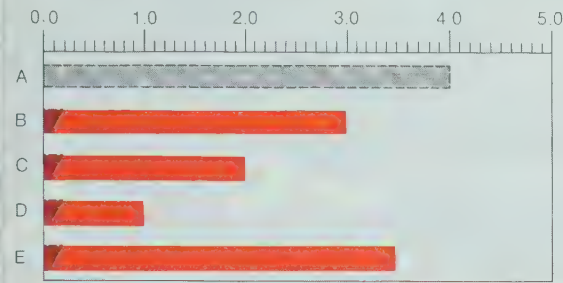
After the exercises are completed, have children explain the reasons for their answers.

Try This: Review the symbol cm³ which is used to der volume. Have the children count the little blocks to find answer for Ex. 1. For Ex. 2, encourage the children to g their answers without counting all the blocks on one fa However, counting the blocks on one face may help th check their answers. Discuss the fact that all the faces h the same area. Ex. 3 challenges the children to think ab the hidden blocks. Providing cubes for children to b similar shapes that are smaller may aid in finding volume of the large block shown.

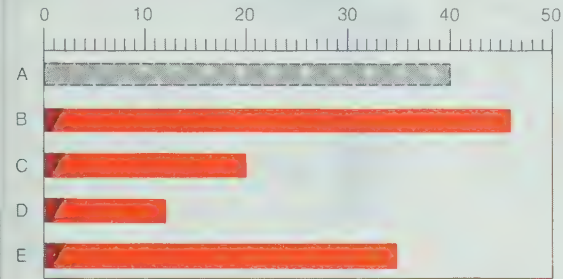
Using Graphs to Show Different Amounts

Graphs can be used to show amounts of any size.

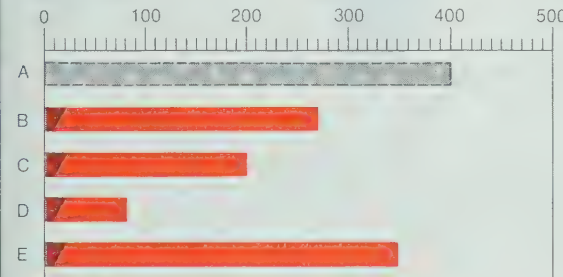
A bar graph drawn here would show amounts from 0.0 to 5.0.



A bar graph drawn here would show amounts from 0 to 50.



A bar graph drawn here would show amounts from 0 to 500.



Exercises

Use tracing paper and complete the bar graphs.

- On the first graph, show
4.0 for A
3.0 for B
2.0 for C
1.0 for D
3.5 for E

- On the second graph, show
40 for A
46 for B
20 for C
12 for D
35 for E

- On the third graph, show
400 for A
270 for B
200 for C
80 for D
350 for E

LESSON OUTCOME

Use bar graphs to show different amounts

Materials

tracing paper and a straight edge for each child

Vocabulary

bar graph

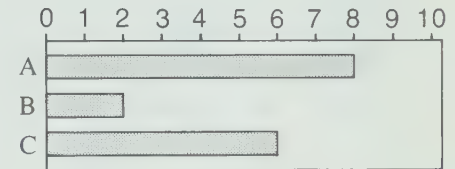
Prerequisite Skills

Interpret bar graphs

Checking Prerequisite Skills

For this graph,

- which bar shows 6? **C**
- which bar shows 8? **A**
- what number is shown by bar B? **2**



RELATED ACTIVITIES

- Encourage the children to find graphs, perhaps from newspapers. Discuss these graphs and place them on the display for Unit 10.
- You may wish to have the children prepare bar graphs to show their interests, for example, their favorite sports or the pets they have at home.

187

LESSON ACTIVITY

Before Using the Page

Ask the children when they have used or seen graphs. They may suggest graphs in this book, graphs they have prepared in school for various subjects, or graphs they have seen in newspapers or magazines.

Using the Page

Ask the children to suggest reasons these graphs are called *bar graphs*.

Read the information for the first graph. Have the children count the numbers shown at the top of the first graph. Ask for the number represented by the first bar.

Read the information for the second graph. Have the children count by ten as they point to the numerals shown. Ask for the number represented by the first bar on this graph. Ask the children to point to the mark they think

would represent 25. Explore their suggestions. Develop how to locate a number between the numerals given.

Read the information for the third graph. Have the children count by hundreds as they point to the numerals on the graph. Ask for the number represented by the first bar on this graph. Explore the children's ideas for the position of 20.

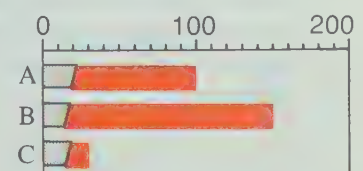
- Ask the children for ways the graphs are the same and ways they are different. Discuss situations for which the different scales (0.0 to 5.0, 0 to 50, and 0 to 500) would be suitable.

Exercises: Point out that the graphs are not complete. Provide tracing paper and straight edges for the children to complete the exercises. Ensure that they understand which graph to use for each exercise.

Assessment

Copy the graph. Show

- 100 for A
- 150 for B
- 30 for C



LESSON OUTCOME

Copy and create patterns using slides

Materials

heavy paper or cardboard, scissors, and a copy of page T 365 or T 366 for each child

Vocabulary

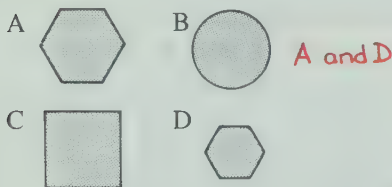
slide

Prerequisite Skills

Recognize similar shapes

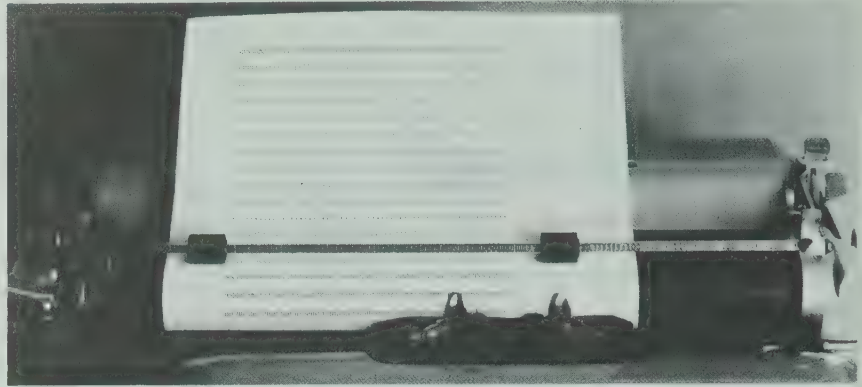
Checking Prerequisite Skills

1. Name two shapes that are similar.



Patterns Using Slides

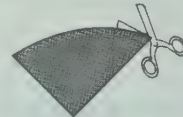
One shape can be used again and again to make a pattern.



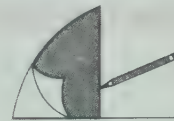
Working Together

Follow these steps to make a pattern.

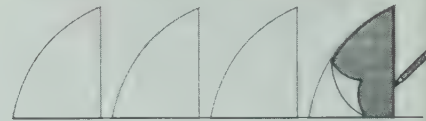
1. A. Cut a shape out of heavy paper or cardboard.



B. Place the shape along a line segment and trace around the shape.



C. Slide the shape along the line segment and trace again and again.

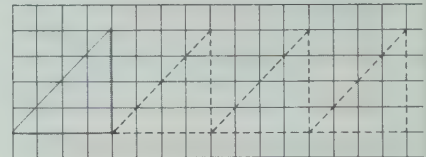


2. Try it again and make another pattern.

Use grid paper or geopaper.

3. Copy the red shape.

4. Copy it four more times to make a pattern across.



188

LESSON ACTIVITY

Before Using the Pages

- Ask the children to name examples of patterns, such as those on fabric or wallpaper.

Using the Pages

- Discuss the typed patterns on page 188. Ask how the shapes are similar. Develop that the pattern is created by sliding one shape across the paper. Discuss the ways of making patterns shown on page 189. Children may wish to comment on methods they have used or would like to try.

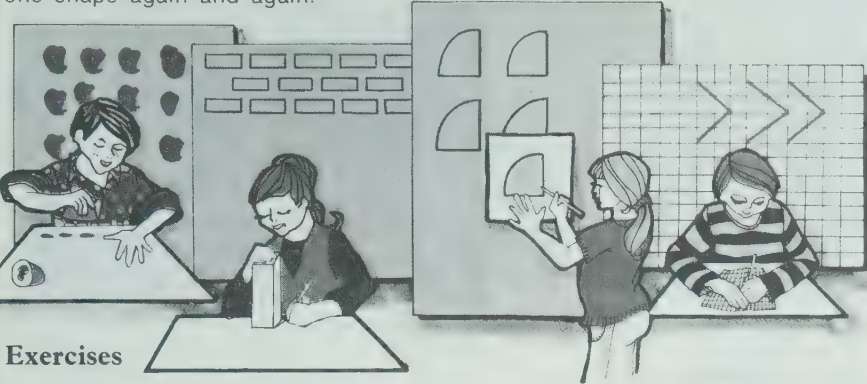
Working Together: Provide the materials required for Ex. 1 and 2. Children who finish Ex. 1 and 2 before the others may enjoy repeating Ex. 2 with a different shape while you help any children who are having difficulty following the instructions.

Then distribute copies of page T 365 or T 366 for Ex. 3 and 4. Ask how the shapes in the pattern for Ex. 3 and 4 are similar. Point out that they are similar and also the same size. Have the children match the shapes square by square. As you help children having difficulty, others can try Ex. 3 and 4 with a shape of their own creation.

Exercises: If children do not understand that the shape for Ex. 3 overlaps, have them compare this pattern with the pattern for Ex. 1 of *Working Together*. For Ex. 4, the children may be interested in comparing the shape in the pattern and the shape of the cutout. Placing the cutout to touch the preceding shape creates a different pattern than if shapes are not touching.

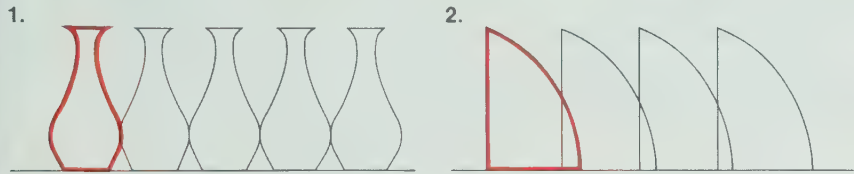
For Ex. 5, remind the children to match each square on their papers with the corresponding square in the book. The patterns created for this lesson would make an interesting display.

Here are some ways to make patterns by using one shape again and again.

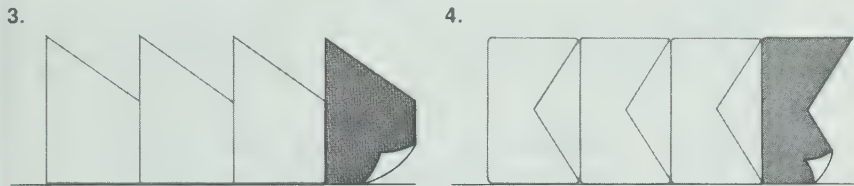


Exercises

Copy the one shape that was used to make each pattern.

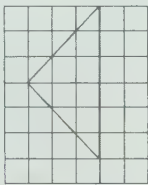


Trace four times around a cutout to make a pattern that looks like this.



Use grid paper or geopaper.

- 5. Copy the red shape.
- 6. Copy it four more times to make a pattern across.
- 7. Copy it four more times to make a pattern up and down.

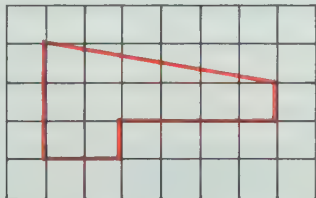


RELATED ACTIVITIES

- Have children collect examples of slide patterns from magazines, wallpaper, and fabric for the display.
- Children may use one shape or a combination of shapes from pages T 355 and T 356. Have them follow the instructions for Ex. 5-7 on page 189 to make a pattern.
- Children may enjoy an art lesson in which they create patterns in one of the ways shown on page 189 or in another way. These could be displayed.

Assessment

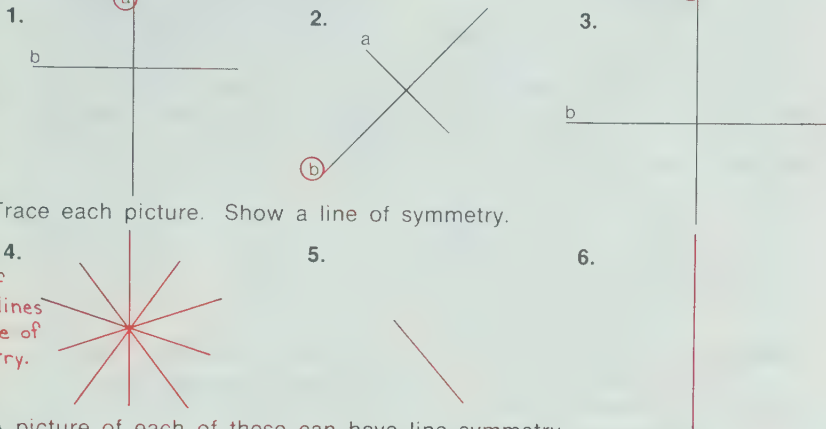
Use grid paper. Copy the red shape. Copy it four more times to make a pattern across.



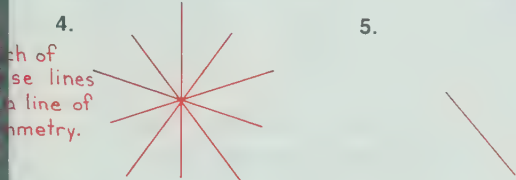


Exercises

Which line is a line of symmetry?



Trace each picture. Show a line of symmetry.



A picture of each of these can have line symmetry. Draw a picture of each. Show a line of symmetry.

7. a face
8. a football
9. a flower
10. a tree
11. a snowflake
12. a tower

For each group, list the members that have line symmetry. Draw the lines of symmetry.



13. the letters of the alphabet, A to Z
14. the numerals, 0 to 9

If the letter "O" is made like a circle, it has many lines of symmetry.

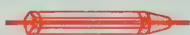


Assessment

Copy this picture. Draw a line of symmetry.



Draw a picture of a crayon. Show a line of symmetry.



RELATED ACTIVITIES

- Have the children find examples of symmetric shapes, for example, leaves, plants, or pictures from magazines. These may be placed on the display.
- Adapt the listing activity described on page T158 and have the children list as many examples as possible having line symmetry.
- Have children find or think of words in which each letter has line symmetry, for example, M A Y, or words that have line symmetry, for example, CHOICE. Then have the children show the lines of symmetry.
- You could prepare a work sheet with words that have many symmetric letters. Instruct the children to show the lines of symmetry, circle the words in which each letter has line symmetry, CAT, and underline each word having line symmetry, BED.
- Children may enjoy making cutouts of symmetric letters, and then folding the cutouts to check the symmetry.
- Children may make cutouts of the geometric shapes on pages T355 and T356 and fold the cutouts along lines of symmetry.

LESSON OUTCOME

Create symmetric shapes

Materials

heavy paper or cardboard, construction paper, scissors, pencils, copies of page T 365, copies of page T 366 and/or geoboards and rubber bands

Vocabulary

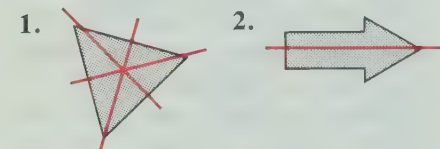
symmetric shapes, flip

Prerequisite Skills

Identify and draw shapes having symmetry; identify and show lines of symmetry; draw geometric shapes

Checking Prerequisite Skills

Copy each of these shapes. Show a line of symmetry.

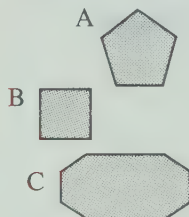


Match each name with the correct shape.

3. rectangle **B**

4. octagon **C**

5. pentagon **A**



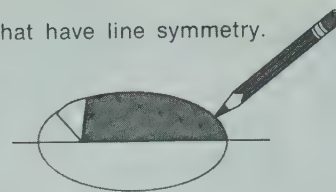
Making Symmetric Shapes

Here are some ways to make shapes that have line symmetry.

Use a cutout.

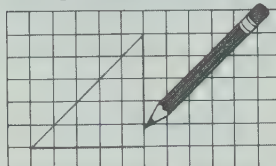


Trace around the cutout.

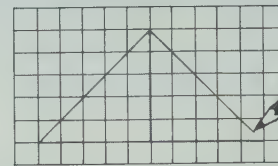


Flip it along one edge and trace around again.

Use grid paper.



Draw one half of a shape.

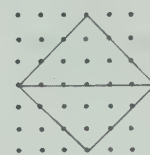


Draw the other half to match the first half square by square.

Use a geoboard.

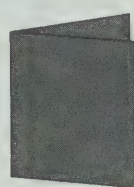


Make one half of a shape.

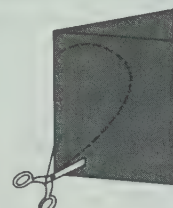


Make the other half to match the first half peg by peg.

Fold and cut.



Fold a piece of paper in half one or more times.



Cut with scissors.



Unfold.

LESSON ACTIVITY

Before Using the Pages

- Ask the children to name objects having line symmetry in the classroom. For each object, have a child trace the line of symmetry using a finger.

Using the Pages

- Ask children to explain the meaning of symmetric shapes in their own words. Tell the children that different ways of making symmetric shapes are shown on page 192. Discuss each method, asking the children how the two halves of each symmetric shape are alike. Encourage the children to use the new vocabulary when discussing the shapes. Point out how the cutout is flipped along one edge in the first method. For the second method, ask the children how the squares on one side of the line of symmetry match the squares on the other side. For the third method, have the children match the two halves of the shape peg by peg. For the fourth method, point out that the paper can be folded in

half more than once and that the shape is cut so that remains as one piece when the paper is unfolded.

Distribute the material for making the symmetric shape. You may wish to have the children choose the order they try the methods. As the children create the symmetric shapes, an opportunity is provided to help children having difficulty with the instructions and to discuss interesting symmetric shapes with individual children. After children understand the methods, encourage them to experiment with various shapes. They may enjoy trying different numbers of folds for the fourth method. Ensure that each child tries each method.

Have children show their work and explain the method in their own words.

Exercises: Provide the materials for the exercises. For Ex. 1-4 you could provide the cutouts or the children could make the cutouts. Copies of pages T 355 and T 356 could be used. Ensure that the children recognize the shape of triangle, a rectangle, a pentagon, and an octagon. Ex. 5-

Exercises

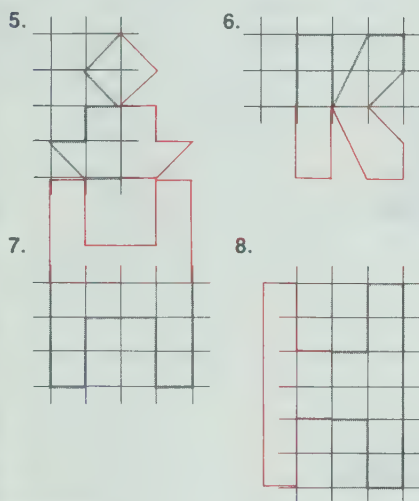
Use cutouts:

Trace around each cutout. Then flip along one edge and trace around again. Use another color to show the line of symmetry.

1. Use a triangle.
2. Use a rectangle.
3. Use a pentagon.
4. Use an octagon.

Use grid paper or a geoboard:

Each picture shows half of a symmetric shape. Copy it and complete the other half of the shape.



Fold paper:

9. Cut out a valentine heart.
- *10. Find a way to fold and cut to make a snowflake.

Add.

1. $\begin{array}{r} 47 \\ + 21 \\ \hline 68 \end{array}$	2. $\begin{array}{r} 425 \\ + 62 \\ \hline 487 \end{array}$	3. $\begin{array}{r} 218 \\ + 140 \\ \hline 358 \end{array}$
4. $\begin{array}{r} 36 \\ + 25 \\ \hline 61 \end{array}$	5. $\begin{array}{r} 609 \\ + 87 \\ \hline 696 \end{array}$	6. $\begin{array}{r} 158 \\ + 316 \\ \hline 474 \end{array}$
7. $\begin{array}{r} 53 \\ + 53 \\ \hline 106 \end{array}$	8. $\begin{array}{r} 272 \\ + 255 \\ \hline 527 \end{array}$	9. $\begin{array}{r} 550 \\ + 380 \\ \hline 930 \end{array}$
10. $\begin{array}{r} 397 \\ + 147 \\ \hline 544 \end{array}$	11. $\begin{array}{r} 179 \\ + 189 \\ \hline 368 \end{array}$	12. $\begin{array}{r} 274 \\ + 336 \\ \hline 610 \end{array}$
13. $\begin{array}{r} 3.2 \\ + 3.1 \\ \hline 6.3 \end{array}$	14. $\begin{array}{r} 6.4 \\ + 2.7 \\ \hline 9.1 \end{array}$	15. $\begin{array}{r} 1.8 \\ + 3.5 \\ \hline 5.3 \end{array}$

Multiply.

16. 4×28	17. 0×50	18. 3×39
19. 5×420	20. 9×327	21. 7×214
22. 7×428	23. 8×540	24. 9×436

Solve.

25. There are 59 color photos and 114 black and white photos. How many photos are there? **173**
26. 178 post cards came from Alberta. 196 came from other provinces. How many post cards are there? **374**
27. Each bicycle has 2 tires. There are 6 bicycles. How many tires are there? **12**
28. A package has 3 flash cubes. There are 5 packages. How many flash cubes are there? **15**

KEEPING SHARP

193

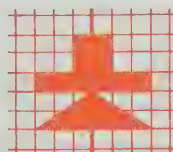
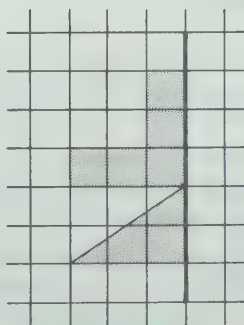
RELATED ACTIVITIES

- Children may enjoy using a method described on page 192 to create other symmetric shapes.
- Children may make half a symmetric shape using a method described on page 192. Then they can trade shapes and complete them. Some children may experiment and be able to find other ways of making symmetric shapes.
- Children could make symmetric shapes with paint. Begin by folding a piece of paper in half. Unfold the paper and paint a spot on one half. Fold the paper along the crease and press. Then unfold the paper and continue the procedure. (Folding the paper after painting each spot prevents the paint from drying and remaining on one side only.)
- Children may enjoy experimenting with mirrors to see symmetric shapes. They may use mirrors on the lines of symmetry for the shapes on page 192 to check the symmetry of the shapes.

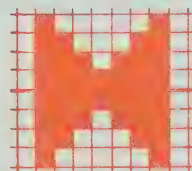
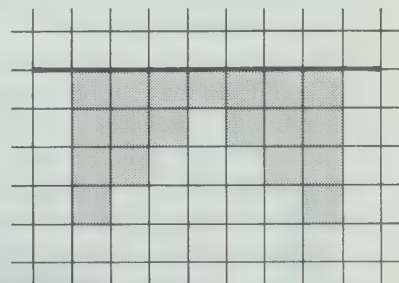
Assessment

Each picture shows half of a symmetric shape. Copy it and complete the other half of the shape.

1.



2.



LESSON OUTCOME

Recognize and demonstrate slides, flips, and turns

Materials

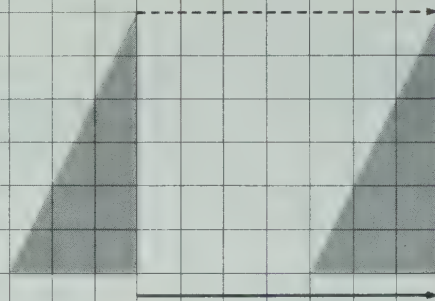
a triangle identical to the triangle at the top of page 194, copies of page T 365 for each child; shapes identical to the shapes in *Working Together* for each child (optional); a book; a demonstration clock

Vocabulary

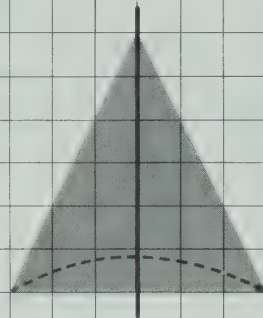
turn

Slides, Flips, and Turns

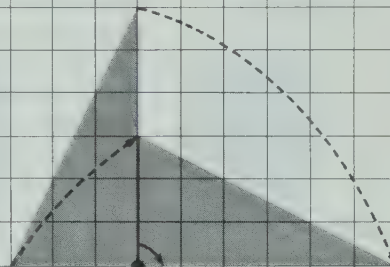
Slide.



Flip.



Turn.



194

LESSON ACTIVITY

Before Using the Pages

- Slide a book across a table in a straight path. Ask:

“Has the shape of the book changed?”

“How has the book moved?”

“What have you seen that moves in a similar way?”

(The children may suggest sliding windows or a child on a slide in a playground.)

Flip over a page in the book. Ask the same questions as for the slide. The children may suggest a casement window or a door as things that move in this way.

Turn a hand on a demonstration clock. Ask the same questions as before. The children may suggest a ferris wheel or a door knob as things that move in this way.

Using the Pages

- Supply each child with a triangle the same as the one at the top of page 194.

Have each child place her/his triangle over the first slide triangle. Ask the children what the arrows and the word *slide* tell them to do. Have each child slide the triangle to the position of the second triangle. Emphasize that the triangle does not turn. Next have them compare the two triangles square by square to discover the ways the triangles are alike. Emphasize that the triangle remains flat on the page for the slide. Have the children try more slides on the page with the cutout.

Follow a similar procedure with the *flip*. When discussing the flip emphasize that the triangle is flipped along one of its edges and that this part remains in contact with the page. The other parts of the triangle do not remain flat on the page during the flip.

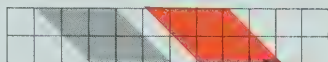
Use a similar method for the *turn*. During the discussion about the turn, develop that the triangle is turned around one vertex and that the triangle remains flat on the page for the turn.

Working Together

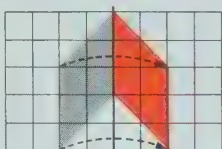
Use grid paper.

- Slide this shape four units to the right.

Draw your result.

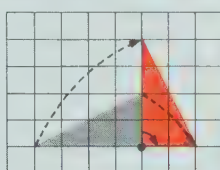


- Flip this shape about the black line.



Draw your result.

- Turn this shape about the black point.



Draw your result.

Exercises

Do you slide, flip, or turn to make the red shape fit the blue shape?

- flip

- flip or slide

- turn or flip (about a diagonal line)

- slide, flip, or turn

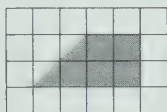
Use grid paper. Copy the red shape for each exercise and then

- slide five units to the right.

- slide three units to the left.

- slide two units up.

- slide one unit down.



- flip it about one of its sides.

- turn it about one of its corners.

Draw a shape on grid paper.

- *11. Make up a slide, flip, or turn problem for a friend.

195

RELATED ACTIVITIES

- Encourage the children to find examples of slides, flips, and turns in their environment and tell the class about these examples.
- Have children collect patterns made by slides, flips, or turns. These could be found in magazines, on wallpaper, on fabric, or they could be drawn. Then have the children decide whether the pattern was made by sliding, flipping, or turning.
- Children may enjoy creating patterns with slides, flips, or turns using some of the materials shown on page 189.
- For an art lesson, have children make six cutouts of any one geometric shape. (Pages T 355 and T 356 could be used.) Then have the children arrange the six cutouts in a slide, flip, or turn pattern and paste them on a piece of paper. The shapes could be cut in two different colors. These would make an interesting display.
- You could plan a gym lesson with the children demonstrating each of a slide, a flip, and a turn in different ways. The children could perform individually or in pairs.

Working Together: Supply each child with a copy of page T 365. You may wish to give each child cutouts for the shapes in the *Working Together* to enable them to try the exercises with cutouts before drawing the shapes.

Have the children copy the red shape for Ex. 1 on their copies of page T 365 matching the shape square by square. Ask children to explain the instructions for Ex. 1. Have the children trace the slide with their fingers and then draw the shape. Follow a similar procedure for Ex. 2, emphasizing the flip action indicated by the arrows. Use a similar procedure for Ex. 3. Emphasize that each vertex follows an arrow.

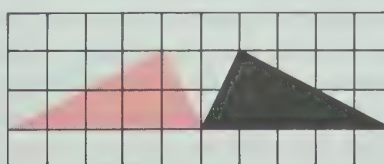
Exercises: Encourage the children to trace the path from a point of the red shape to the corresponding point of the blue shape to determine whether a slide, a flip, or a turn is shown. While the children are completing the exercises, an opportunity is provided to help children having difficulty and to allow the children to comment on interesting aspects

of the shapes. Discuss that Ex. 3 could be a slide or a flip and that Ex. 4 could be a slide, a flip, or a turn. Ensure that the children understand that Ex. 5-10 each requires copying the red shape. Have the children try their own problems for Ex. 11 before trading them. Some children may enjoy creating more than one problem for Ex. 11.

Assessment

Does a slide, flip, or turn make the red shape fit the black shape?

1.



flip

2.



turn

LESSON OUTCOME

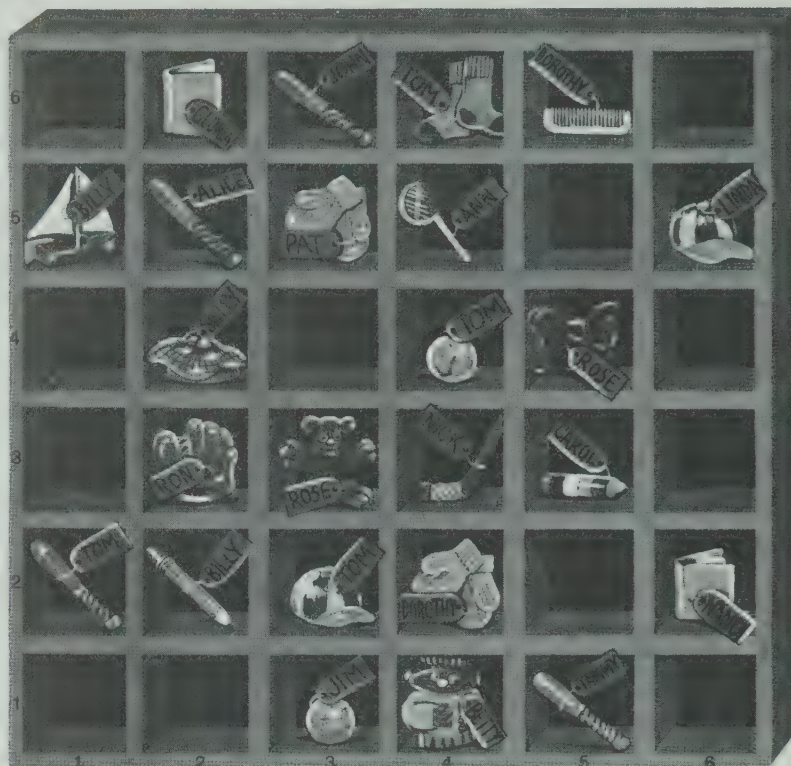
Match ordered pairs of numbers with positions in an array

Background

Remembering that the first number of a number pair indicates the number of places over and that the second number indicates the number of places up is an important part of this lesson.

Positions and Pairs of Numbers

Dorothy's mittens are in box (4, 2).



To find Dorothy's mittens,
count over 4 and up 2.

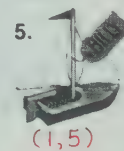
Always count over first, then up, to match a box with a pair of numbers.

Working Together

Whose hat is in

1. box (2, 4)? Sally's
2. box (3, 2)? Tom's
3. box (6, 5)? Linda's

What pair of numbers tells you where to find each of these?



LESSON ACTIVITY

Using the Pages

- Direct the children's attention to the picture on page 196. They may wish to comment on the boxes or the articles in the boxes. Read the statement at the top of the page. Have the children point to Dorothy's mittens. Ask them to suggest reasons for calling the box with Dorothy's mittens box (4, 2). Develop that the number over is four and that the number up is two. Read the statement underneath the picture. Emphasize that the first number always tells the number of places over and that the second number always tells the number of places up. Thinking about how they would take an object from a high arrangement of boxes similar to the one in the picture may help the children remember the order of a pair of numbers. If the boxes are high, the children would probably walk over to the position of the object and then reach up to take the object. You may wish to have a child demonstrate this.

Establish that each box is identified by only one pair of numbers and that each box, even an empty box, is identified by a pair of numbers.

Working Together: For Ex. 1-3, have each child point to the bottom left corner of the array of boxes. Then have them point to each box as they count over for the first number of the pair. Next have them point to each box as they count up for the second number of the pair. For each pair of numbers, discuss the order of the numerals, the bracket around the numerals, and the comma between the numerals. For Ex. 4 and 5, remind the children how to write the pairs of numbers. Have children ask questions similar to Ex. 4 and 5 for others to answer.

Exercises: Children can refer to page 196 for the way to write the answers for Ex. 1-8. Some children may need to be reminded about the meaning of *row* and *column* for Ex. 1 and 18. Ensure that the children understand the instruction for Ex. 20 and 21.

Exercises

What pair of numbers tells you where to find each of these?


1.
(5,1)




2.
(4,4)




3.
(2,3)




4.
(3,5)




5.
(3,1)



6.
(2,6)



7.
(5,4)



8.
(2,2)



Whose things are in

9. box (6,2)? 10. box (3,3)?
Nancy's Rose's
11. box (2,5)? 12. box (4,1)?
Alice's Betty's
13. box (5,6)? 14. box (3,6)?
Dorothy's John's
15. box (4,5)? 16. box (5,3)?
Ann's Carol's

What are the number pairs for

17. the empty boxes in the bottom row? (1,1), (2,1), (6,1)
18. the empty boxes in the first column? (1,1), (1,3), (1,4), (1,6)
19. all the boxes holding Tom's things? (1,2), (3,2), (4,4), (4,6)

The numbers in the pair (3,3) add to 6.

20. List all the pairs whose numbers add to 6.
(1,5), (5,1), (2,4), (4,2), (3,3)
21. Name the children whose things are in those boxes.
(1,5) Billy
(5,1) Tammy
(2,4) Sally
(4,2) Dorothy
(3,3) Rose

Subtract.

1. 67
- 23

44

2. 179
- 42

137

3. 983
- 741

242

4. 532
- 6

526

5. 293
- 34

259

6. 777
- 418

359

7. 547
- 91

456

8. 619
- 483

136

9. 908
- 651

257

10. 811
- 639

172

11. 962
- 493

469

12. 732
- 85

647

13. 101
- 67

34

14. 600
- 356

244

15. 500
- 218

282

Divide.

16. $2 \div 2 = 1$
17. $6 \div 3 = 2$
18. $4 \div 1 = 4$
19. $25 \div 5 = 5$
20. $12 \div 4 = 3$
21. $18 \div 3 = 6$
22. $32 \div 4 = 8$
23. $21 \div 3 = 7$
24. $45 \div 5 = 9$

Solve.

25. There are 272 bean seeds and 158 pumpkin seeds. How many fewer pumpkin seeds than bean seeds are there? 114
26. There are 375 pieces to the puzzle. 193 pieces have been put together. How many pieces are left to be put together? 182
27. There are 16 seeds to plant. Each pot gets 2 seeds. How many pots are needed? 8
28. 3 players share 21 playing cards equally. How many does each player get? 7

KEEPING SHARP

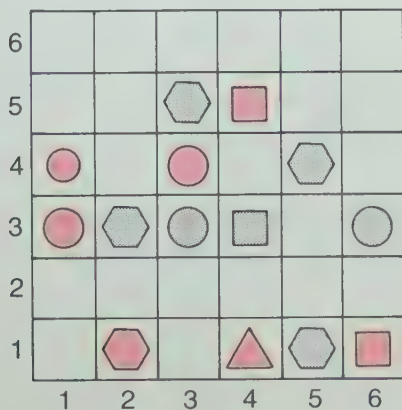
197

RELATED ACTIVITIES




- Prepare and number squares on the floor in a way similar to the boxes on page 196. (Use a tiled floor or masking tape.) Have the children begin at square (1, 1) and then walk to a specified square. Emphasize walking over first and then up. This could be reversed by having a child stand in a square and ask for the number pair for the square.
- Have three to seven children each number the rows and columns on part of a copy of page T365 similar to the way the boxes on page 196 are numbered. A leader marks a square on her/his paper without displaying the paper and then states, "I'm thinking of a square." The other players take turns asking questions that can be answered by "Yes" or "No". For example, they could ask, "Is the first number in the number pair six?", "Is the square in the first row?", or "Is the number pair for the square (2, 3)?" Each child records the answers to the questions on her/his grid by crossing out eliminated squares and checking possible squares or by any method the player chooses. The first player to guess the correct number pair is the winner.

Keeping Sharp: Ex. 1-24 review subtraction and division facts and skills. Review regrouping with any children having difficulty. Encourage the children to find the quotient for any division fact they do not remember. The word problems require distinguishing between subtraction and division situations.

Assessment



Give the number pair for

1.  2. 
(2,1) (4,3)
3. Draw the shape in box (4, 1). 
4. What is the number pair for the empty box in the third row? (5,3)

LESSON OUTCOME

Match ordered pairs of numbers with points on a grid

Materials

copies of page T 365 for each child

Vocabulary





grid, line graph

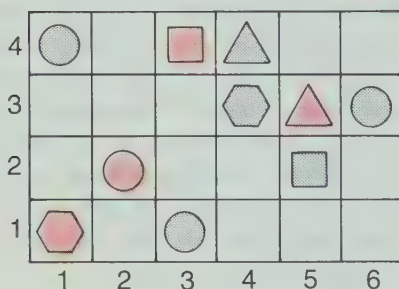
Prerequisite Skills

Match ordered pairs of numbers with positions on a grid

Checking Prerequisite Skills

Give the number pair for

1.  (2,2) 2.  (4,3) 3.  (4,4)
4. Draw the shape in box (3, 4). 



Background

On page 198, the grid lines are numbered instead of the rows and the columns of squares as on page 196. These are two different ways of naming a position.

LESSON ACTIVITY

Using the Pages

- Read the information about the game at the top of page 198. Tell the children that for these grids, each pair of numbers refers to a point, not a square as on pages 196-197. Explain that these are two different methods of locating positions and both are correct. Have the children point to each line on Elsa's grid as they count over and then up to check each of David's guesses. Then have them count over and then up to give the number pair for each point that David did not guess.

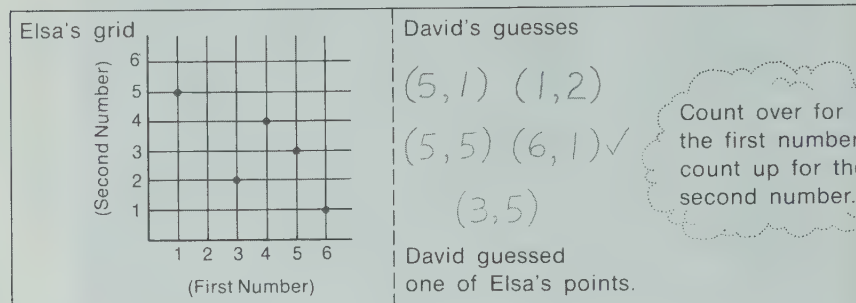
Use a similar procedure to check Elsa's guesses for David's grid on page 199. Have the children decide who won the game.

Positions on a Grid

Elsa and David played this game.

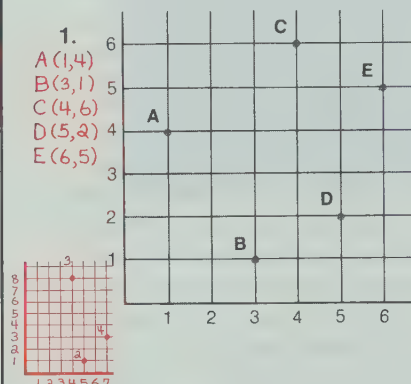
Each drew a grid. They numbered the lines and placed five points.

Then each guessed five pairs of numbers. Whoever guessed more of the other player's points won the game.



Working Together

Count over, then up to match each point with a number pair.



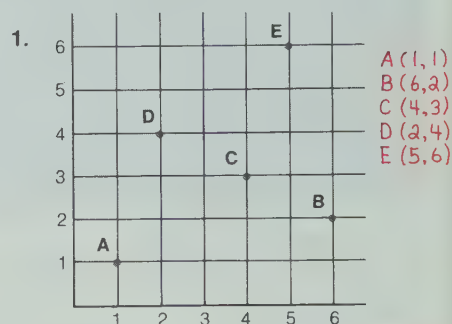
Draw a grid. Number the lines. Place these points.

2. (5,1) 3. (4,8) 4. (7,3)

198

Exercises

Write the number pair that matches each point.

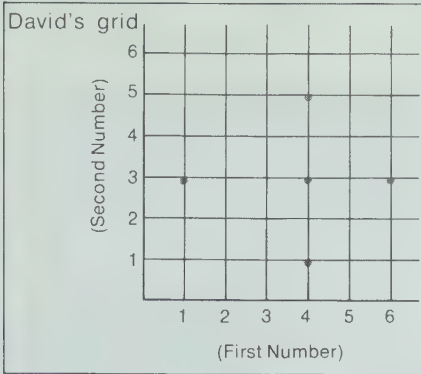


Draw a grid. Number the lines. Place these points.

2. (4,2) 3. (3,6) 4. (6,1)
5. (5,7) 6. (2,8) 7. (8,2)
8. (1,6) 9. (9,5) 10. (7,10)

Working Together: Review the way to write the number pair for Ex. 1. For Ex. 2-4, draw a number grid on the board. Have children number the lines and place the points. You may wish to provide more examples.

Exercises: Give each child copies of page T 365 for Ex. 2-1. Have the children follow the instructions for Ex. 11 and in the order they are given. For Ex. 13, ensure that the children understand how to join the points resulting in the shape of an envelope. Ex. 14 provides an opportunity to discuss March temperatures of the area where the children live. Ask why this type of graph is called a *line graph*. Develop that the points are joined by line segments that indicate changes in temperature.



Elsa's guesses

(2,3) (3,4)
 ✓(4,5) (5,4)
 (6,3)✓

How many of David's points did Elsa guess? **2**

Who won the game? **Elsa**

Draw a grid. Number the lines. Place the four points. Ring the point not in line with the others.

11. (2,1) (3,2) (4,5) (7,6)
 12. (3,3) (3,9) (6,6) (8,4)

Bobby kept track of the temperature outside when he awoke each morning in March.

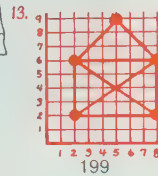
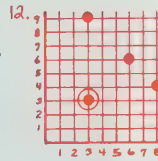
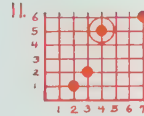
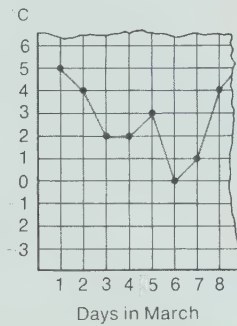
MARCH						
	1	2	3	4	5	6
	5°C	4°C	2°C	2°C	3°C	0°C
7	8	9	10	11	12	13
1°C	4°C	5°C	3°C	1°C	-2°C	-3°C
14	15	16	17	18	19	20
-3°C	-1°C	0°C	5°C	3°C	6°C	5°C
21	22	23	24	25	26	27
6°C	6°C	8°C	10°C	9°C	3°C	4°C
28	29	30	31			
2°C	4°C	6°C	7°C			

Want to know a good way to send a message? Draw a grid. Number the lines. Then draw point to point to find a way.

13. Draw (2,2) → (8,2) → (2,6)
 → (8,6) → (5,9) → (2,6)
 → (2,2) → (8,6) → (8,2)

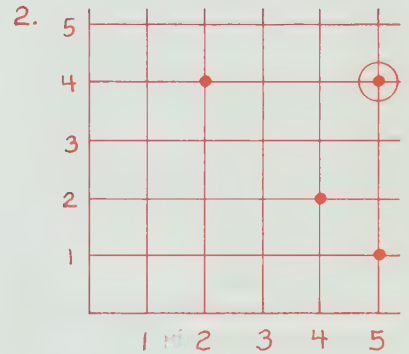
He made a **line graph** to show the temperatures.

14. Complete the line graph.



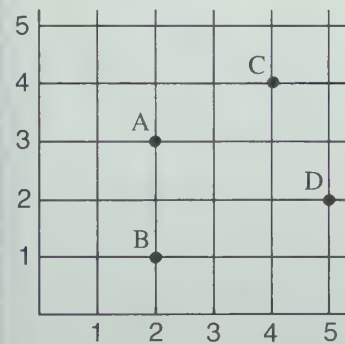
RELATED ACTIVITIES

- Have the children record the temperature daily on a line graph. This could be a large graph on display and/or individual graphs made with copies of page T 365. Preparing a graph for each month reinforces the understanding of temperature and the use of line graphs.
- Have the children search for examples of line graphs in newspapers and magazines. These could be placed on the display.
- Children may enjoy trying the game played by Elsa and David on pages 198-199.
- Adapt the activities on page T 215 by numbering the lines and referring to the points.
- Children can use pairs of numbers in a way similar to Ex. 13 on page 199 to send messages or to spell their names.



Assessment

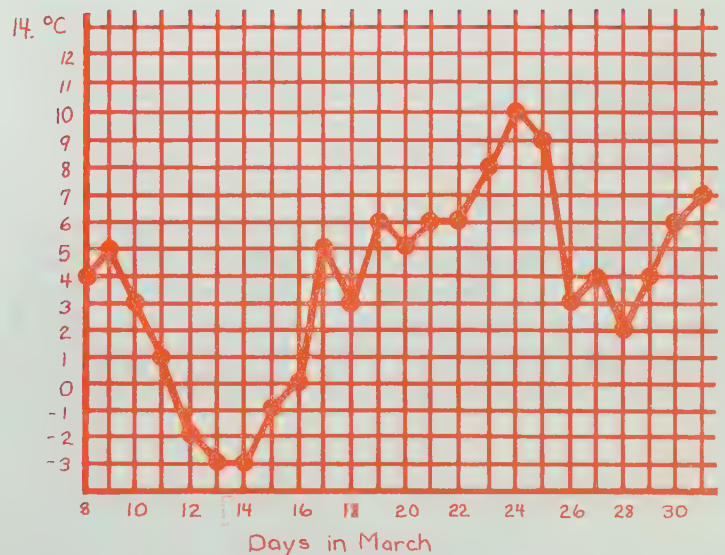
Write the number pair that matches each point.



- A (2,3)
 B (2,1)
 C (4,4)
 D (5,2)

Draw a grid. Number the lines. Place the points. Ring the point in line with the others.

- (4,2)
 (2,4)
 (5,4)
 (5,1)



OBJECTIVE

Demonstrate an understanding of the concepts and skills presented in this unit

RELATED ACTIVITIES

• Have children create a shape with tangram pieces made from page T368. Then have them line up the edges of the tangram pieces with the lines on a copy of page T365 and trace the shape. The tangram pieces may be used for some of the following activities.

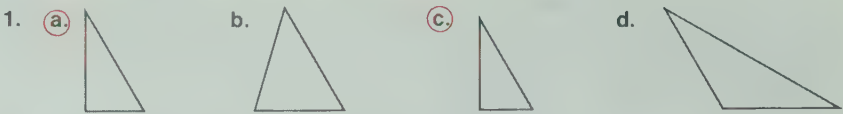
- 1. Draw a similar shape on a piece of paper having larger squares.
- 2. Color the region covered by the shape and find the area of the region.
- 3. Make a cutout of one of the tangram pieces. Create a slide, a flip, or a turn pattern using the cutout.

• Children may enjoy the challenge of finding different things to build with a specified number of centimetre cubes.

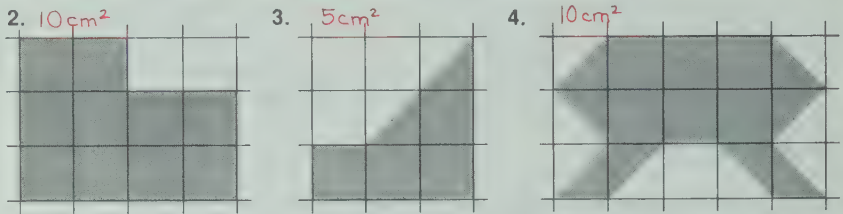
• Children can paint a symmetric shape as follows. Fold a piece of paper in half. Dip a piece of string in some paint until all the string except the end is covered with paint. Place the string in a curved shape on half of the paper with the dry end off the edge of the paper. Fold the paper in half and press. While pressing the paper, carefully pull the string away from the paper. Unfold the paper.

Checking Up

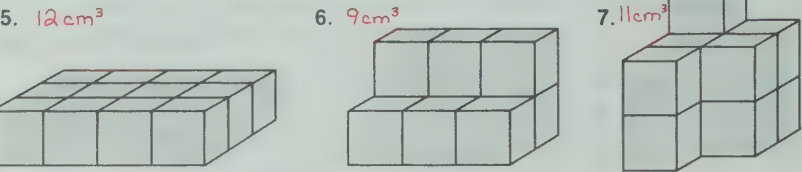
Find the two pictures that are similar.



Find the area of each region in square centimetres (cm^2).



Find each volume in cubic centimetres (cm^3).



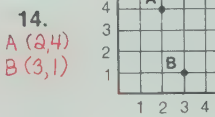
Which line is a line of symmetry?



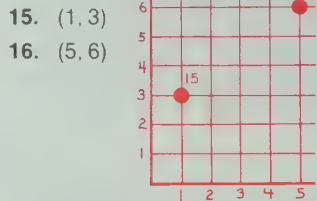
Do you slide, flip, or turn to make the red shape fit the blue shape?



Write the number pair that matches each point.



Draw a grid. Number the lines. Place these points.



Skills	Exercises	Related Pages
Recognize similar shapes	1	T 198-T 199
Find area by counting square centimetres	2-4	T 201
Find volume by counting cubic centimetres	5-7	T 202-T 203
Identify lines of symmetry	8-10	T 208-T 209
Slide, flip, or turn a shape	11-13	T 212-T 213
Match ordered pairs of numbers with points on a grid	14-16	T 216-T 217

Comments

Tracing the shapes for Ex. 1 may help children find the pictures that are similar.

Ensure that the children include the symbol cm^2 for Ex. 2, and the symbol cm^3 for Ex. 5-7. It may be necessary to review how to write these symbols. If the children have difficulty understanding that two halves of 1 cm^2 make 1 cm^2 , you may have them combine two half squares. They could trace the perimeter of a region that covers half of 1 cm^2 and place the traced shape next to another region that covers half of 1 cm^2 . Review how the two half squares can be arranged to cover 1 cm^2 . Children who have difficulty understanding the concept of volume involved in Ex. 5-7 may build the shapes shown and count the blocks.

Tracing paper could be used to verify any answers for Ex. 8-13 that the children find difficult.

Errors for Ex. 14-16 may be caused by forgetting to count over and then up.

Checking Skills

Add.

1. $\begin{array}{r} 34 \\ + 42 \\ \hline 76 \end{array}$	2. $\begin{array}{r} 234 \\ + 14 \\ \hline 248 \end{array}$	3. $\begin{array}{r} 712 \\ + 215 \\ \hline 927 \end{array}$
4. $\begin{array}{r} 537 \\ + 56 \\ \hline 593 \end{array}$	5. $\begin{array}{r} 324 \\ + 638 \\ \hline 962 \end{array}$	6. $\begin{array}{r} 259 \\ + 633 \\ \hline 892 \end{array}$
7. $\begin{array}{r} 391 \\ + 12 \\ \hline 403 \end{array}$	8. $\begin{array}{r} 385 \\ + 374 \\ \hline 759 \end{array}$	9. $\begin{array}{r} 131 \\ + 485 \\ \hline 616 \end{array}$
10. $\begin{array}{r} 286 \\ + 217 \\ \hline 503 \end{array}$	11. $\begin{array}{r} 185 \\ + 389 \\ \hline 574 \end{array}$	12. $\begin{array}{r} 396 \\ + 289 \\ \hline 685 \end{array}$
13. $\begin{array}{r} 1.5 \\ + 0.2 \\ \hline 1.7 \end{array}$	14. $\begin{array}{r} 0.5 \\ + 7.6 \\ \hline 8.1 \end{array}$	15. $\begin{array}{r} 2.8 \\ + 4.2 \\ \hline 7.0 \end{array}$

Subtract.

1. $\begin{array}{r} 176 \\ - 14 \\ \hline 162 \end{array}$	2. $\begin{array}{r} 536 \\ - 402 \\ \hline 134 \end{array}$	3. $\begin{array}{r} 789 \\ - 510 \\ \hline 279 \end{array}$
4. $\begin{array}{r} 52 \\ - 36 \\ \hline 16 \end{array}$	5. $\begin{array}{r} 567 \\ - 18 \\ \hline 549 \end{array}$	6. $\begin{array}{r} 880 \\ - 237 \\ \hline 643 \end{array}$
7. $\begin{array}{r} 455 \\ - 72 \\ \hline 383 \end{array}$	8. $\begin{array}{r} 966 \\ - 490 \\ \hline 476 \end{array}$	9. $\begin{array}{r} 233 \\ - 181 \\ \hline 52 \end{array}$
10. $\begin{array}{r} 378 \\ - 179 \\ \hline 199 \end{array}$	11. $\begin{array}{r} 612 \\ - 247 \\ \hline 365 \end{array}$	12. $\begin{array}{r} 451 \\ - 297 \\ \hline 154 \end{array}$
13. $\begin{array}{r} 504 \\ - 26 \\ \hline 478 \end{array}$	14. $\begin{array}{r} 300 \\ - 65 \\ \hline 235 \end{array}$	15. $\begin{array}{r} 800 \\ - 441 \\ \hline 359 \end{array}$

Multiply.

1. $1 \times 5 = 5$	2. $2 \times 4 = 8$
3. $0 \times 2 = 0$	4. $3 \times 3 = 9$
5. $2 \times 3 = 6$	6. $5 \times 2 = 10$
7. $4 \times 3 = 12$	8. $3 \times 5 = 15$
9. $8 \times 2 = 16$	10. $5 \times 4 = 20$
11. $6 \times 3 = 18$	12. $9 \times 2 = 18$
13. $7 \times 5 = 35$	14. $9 \times 3 = 27$
15. $8 \times 4 = 32$	16. $7 \times 3 = 21$
17. $6 \times 5 = 30$	18. $9 \times 5 = 45$
19. $7 \times 4 = 28$	20. $8 \times 5 = 40$
21. $5 \times 5 = 25$	22. $4 \times 4 = 16$
23. $8 \times 3 = 24$	24. $7 \times 1 = 7$
25. $9 \times 4 = 36$	26. $6 \times 5 = 30$

Divide.

1. $4 \div 2 = 2$	2. $2 \div 1 = 2$
3. $4 \div 4 = 1$	4. $6 \div 2 = 3$
5. $3 \div 3 = 1$	6. $20 \div 5 = 4$
7. $10 \div 5 = 2$	8. $12 \div 2 = 6$
9. $8 \div 2 = 4$	10. $18 \div 2 = 9$
11. $14 \div 2 = 7$	12. $24 \div 4 = 6$
13. $28 \div 4 = 7$	14. $25 \div 5 = 5$
15. $40 \div 5 = 8$	16. $24 \div 3 = 8$
17. $36 \div 4 = 9$	18. $45 \div 5 = 9$
19. $15 \div 3 = 5$	20. $32 \div 4 = 8$
21. $30 \div 5 = 6$	22. $16 \div 2 = 8$
23. $20 \div 4 = 5$	24. $21 \div 3 = 7$
25. $18 \div 3 = 6$	26. $12 \div 4 = 3$

201

OBJECTIVE

Demonstrate competence in addition and subtraction skills; recall multiplication and division facts

RELATED ACTIVITIES

- Activities or games from the preceding units may be used for a review of concepts or facts causing difficulty or for enrichment in areas of interest.
- To reinforce multiplication facts, cards similar to the following could be used for the game "Match Up" described on page T 349.

9×3

27

- Cards similar to the following could be used for the game "Match Up" on page T 349 to review division facts.

$24 \div 6$

4

LESSON ACTIVITY

Using the Page

In the addition section, Ex. 1-3 involve addition with no regrouping. Ex. 4-6 involve regrouping 10 ones as 1 ten. Ex. 7-9 involve regrouping 10 tens as 1 hundred. Ex. 10-12 require two regroupings. Ex. 13-15 involve addition of decimals.

In the subtraction section, Ex. 1-3 involve subtraction with no regrouping. Ex. 4-6 involve regrouping 1 ten as 10 ones. Ex. 7-9 involve regrouping 1 hundred as 10 tens. Ex. 10-12 require two regroupings. Ex. 13-15 involve regrouping with zeros.

In the multiplication section, the multiplication facts presented in Unit 8 are reviewed.

In the division section, the division facts presented in Unit 9 are reviewed.

- For the addition and subtraction sections, emphasize accuracy and speed. Review any aspect of regrouping that children find difficult by adapting the lesson and activities on the appropriate pages. For the addition exercises with decimals, remind the children that the decimal point is necessary to show tenths.

For the multiplication and division exercises, emphasize the meaning of multiplication and division and the ways to find answers that are not remembered.

- You may wish to have the children complete each section at a different time. The sections could be followed with an activity selected from the corresponding unit.

Unit 11 Overview

Numeration

This unit introduces the concept of *thousand* which the teacher may have mentioned earlier, but this is the first use of it in the text. Clearly, the emphasis of the unit is to review and extend place-value aspects of the numeration system to the thousands' place. One thousand is presented as being equivalent to ten hundreds, while a four-place numeral is shown to be made up of thousands, hundreds, tens, and ones. The children are then given numerous opportunities to investigate and consolidate their place-value concepts through expanded notation, regrouping, comparing, ordering, and renaming numbers.

While most of the unit deals with place-value concepts, fraction concepts are included in the latter part of the unit. Previously, fractions were used to represent parts of a whole. In this unit, fractions are used to represent parts of a set.

Prerequisite Skills




- read and write standard numerals and words, interpret place value, write the expanded form, regroup, compare and order numbers to 999
- read and write numerals for fractions for parts of a whole

Unit Outcomes

- read and write standard numerals and words for numbers to 9999
- interpret place value in numerals to 9999
- write the expanded form for numbers to 9999
- regroup thousands, hundreds, tens, and ones
- compare and order numbers to 9999
- read and write numerals for fractions for parts of sets (halves, thirds, fourths, tenths); solve related word problems
- solve incomplete word problems

Background

Unit 2 reviewed the terminology, notation, and structure of our base-ten system of numeration. Because we are so familiar with this system we may not appreciate fully just how simple and yet how effective it really is. A review of other numeration systems at this time can help to demonstrate the advantages of our own system.



In the earliest days, pebbles were likely used to keep a count of objects, one pebble for one object. Another method used notches cut in a stick, but the relationship was still one to one, one notch for one object. Eventually, written symbols were used to represent numbers. Over a long period of time as civilizations grew and technology improved, it became necessary to find ways of representing large numbers and performing operations with numbers. The Egyptians developed a system that used symbols for powers of ten; for example, one was shown as a stroke, |. The symbol for ten was ;  represented one hundred; and  represented one thousand. Because there were no symbols for numbers other than powers of ten, it was necessary to repeat a symbol to show the number of ones, the number of tens, the number of hundreds, and so on. For example, the number two thousand three hundred sixty-five would be shown in the following way.



Note that because the system lacked place value, rearranging the order of the symbols did not change the number represented. For example, the following numeral is one of many others that also names the number two thousand three hundred sixty-five. Contrast this with the result of rearranging the digits of 2365 as 6532.



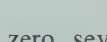


It is easy to imagine the difficulties that would be encountered in computing simple additions and subtractions, let alone the more complicated operations of multiplication and division.




The Babylonian system was based on the numbers ten and sixty. This system possessed the property of place value. A wedge-shaped symbol changed in value not only according to its position in the numeral but also according to whether it was written vertically () or horizontally () as shown below

				
36 000	3 600	600	60	10

Each symbol was repeated as needed. For example,

4	(1 + 1 + 1 + 1)	
41	(10 + 10 + 10 + 10 + 1)	
71	(60 + 10 + 1)	

Note that since there was no symbol for zero, several numbers could have the same numeral. For example,

11	(10 + 1)	
660	(600 + 60)	
39 600	(36 000 + 3 600)	

Apparently, the context in which the symbols occurred helped to determine their meaning. A symbol for zero would have eliminated the confusion by permitting vacant places to be indicated.

The Chinese system is of interest in that there are two sets of symbols, one set for the numbers 1 to 9, and another set for the powers of ten (10, 100, 1000, . . .). A particular numeral formed by expressing the number in powers of ten, or, as we know it, in expanded notation.

Chinese symbol	Value	For example, 237 is the same as $2 \times 100 + 3 \times 10 + 7$, or	
一	1	two	二
二	2	hundreds	百
三	3	three	三
四	4	tens	十
五	5	seven (ones)	七
六	6		
七	7	206 is the same as $2 \times 100 + 6$, or	
八	8	two	二
九	9	hundreds	百
十	10	six	六
百	100		

Note that although this system would seem to have many of the advantages of our own base-ten system, it is necessary in these numerals to indicate the powers of ten each time. This is necessary because there is no symbol for zero. A symbol for zero is not needed in expanded notation because the appropriate power of ten is merely omitted, as illustrated above for 206 (no zero).

The symbols 0, 1, 2, . . . , 9 used today are of Hindu-Arabic origin. Of these ten symbols, the most recent and most important is zero. The invention of a symbol to represent zero was a major turning point in the development of mathematics because it led to the formation of a place-value system which, based on the number ten, is the system we use today.

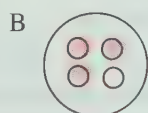
Four-place numerals provide another opportunity to emphasize ten as the base of our numeration system. The number *one* is represented by the digit 1. To represent ten ones (one ten) the digit 1 is used again, but it is written one place to the left and another 0 is written in the ones' place. To represent ten tens (one hundred) the digit 1 is written one more place to the left and another 0 is written to its right. Similarly, to represent ten hundreds (one thousand) the digit 1 is written one more place to the left and another 0 is written to its right.

A four-place numeral represents thousands, hundreds, tens, and ones, and a digit in any of the four places signifies both its face value and its place value. In the numeral 1345, the digit 5 has the greatest face value and the least place value. The digit 1 is the most significant because its place value is thousands, the 3 represents hundreds, the 4 represents tens, and the 5 represents ones. Note that the word *and* is not used between the values of whole numbers. The numeral 1345 is read "one thousand three hundred forty-five". The word *and* is used, however, between whole numbers and fractions or decimals, as in 2.5 ("two and five-tenths") and $4\frac{1}{2}$ ("four and one-half").

Unit 2 reviewed the concept of fractions less than one as parts of a whole for halves, thirds, fourths, and tenths. In this unit, children associate the same fractions with parts of a set. For example, in Unit 2, $\frac{3}{4}$ was associated with a shape that was divided into four equal parts, three of which were special, for example, red (A). The same fraction, $\frac{3}{4}$, can be associated with a set of four objects of which three are red and one is not red (B).



A
 $\frac{3}{4}$ of the shape is red.



B
 $\frac{3}{4}$ of the set is red.

It should be noted that in this unit, the number of objects in a set is the same as the number in the denominator of the fraction. For example, a set of two objects is associated with halves, a set of four objects with fourths, and so on.

Teaching Strategies

An introduction to the concept of *thousand* is best accomplished by a demonstration with objects to emphasize the grouping by tens structure of our numeration system. Suitable objects include those that were suggested in unit 2 for work with ones, tens, and ones, such as Multibase Arithmetic Blocks, base ten blocks, cubes, and cardboard strips and squares. Small sticks or beads are a convenient size for grouping by tens to show hundreds and thousands.

Concrete representation of one thousand is important. Many children readily recognize the numeral 1000 as representing *one thousand* from their out-of-school experiences, but they frequently fail to realize the 10 hundreds implied by the numeral 1000. Concrete representation of one thousand as ten hundreds can help children to realize that ten hundreds is the same as one thousand. This, in turn, can help them to understand the procedure of regrouping for four-digit numbers which is important for future work with addition and subtraction. The work with concrete materials can then be related to similar work using semi-abstract aids such as the place-value pocket chart and the abacus.

For comparison of two numbers, the procedure is a simple one if the numbers do not have the same number of places. At a glance it is obvious that 1000 (four places) is greater than 999 (three places). Comparing numbers with the same number of digits requires examination from the left until a difference is noted. For instance, in comparing 2732 and 2735, the thousands are the same (2), the hundreds are the same (7), the tens are the same (3), but the ones are different (2 and 5). Since 5 is greater than 2, the number 2735 is greater than the number 2732. Children need considerable experience looking at numbers in this way.

To investigate the concept of part of a set, children can help to prepare their own set of ten paper counters that are colored red on one side and blue on the other. For fourths, children would display four counters. To show $\frac{3}{4}$ of the set red, for example, children would show the red side for three counters and blue side for one counter. As mentioned earlier, the number in the set would correspond to the denominator of the fraction. The numerator would correspond to the number of special objects, in this case, counters that are red.

Materials

models for thousands, hundreds, tens, and ones for each child
two numeral cards for each of the numbers 0 to 9
metre sticks
piece of fabric
copy of page T 365 for each child
counters of different colors for each child
box of crayons

Vocabulary

names for numbers from *one thousand* to *nine thousand nine hundred ninety-nine*
thousands
cross-country race
championship
kilometre
history
sets
reverse
Magic Square
information

LESSON OUTCOME

Read and write standard numerals and words for numbers to 9999; interpret place value in numerals to 9999

Materials

display models for 1 to 9 thousands; 10 hundreds, 9 tens, and 9 ones for each child; metre sticks

Vocabulary

names for numbers from one thousand to nine thousand nine hundred ninety-nine, thousands, kilometre

Prerequisite Skills

Read and write standard numerals for the numbers to 999

Checking Prerequisite Skills

Complete each of the following.

1. $380 = \begin{array}{r} 3 \\ 8 \\ 0 \end{array}$ hundreds
tens
ones

2. $991 = \begin{array}{r} 9 \\ 9 \\ 1 \end{array}$ hundreds
tens
one

Write the numeral.

3. six hundred two 602

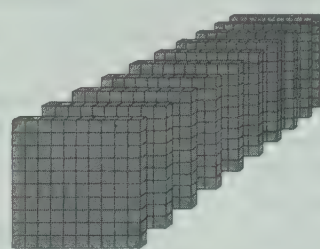
Write the words.

4. 837 5. 405
4. eight hundred thirty-seven
5. four hundred five

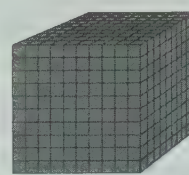
11 NUMERATION

Numbers to 9999

Ten hundreds are equal to **one thousand**.



10 hundreds



1 thousand

One thousand can be shown like this **1000**

1. 4000 four thousand
5000 five thousand
6000 six thousand
7000 seven thousand
8000 eight thousand
9000 nine thousand

Working Together

Continue this table to nine thousand.

1.	1000	one thousand
	2000	two thousand
	3000	three thousand

Write the numerals.

2. 6 thousands 2 hundreds 3 tens 7 ones 6237
3. 2 thousands 6 hundreds 5 tens 2650
4. 5 thousands 4 tens 5040

For the numeral 3409, tell the number of

5. thousands. 3 6. hundreds. 4 7. tens. 0 8. ones. 9

Write the numerals.

9. seven thousand two hundred forty-six 7246 10. four thousand thirty 4030
11. five thousand eighty-three 5083 12. six thousand two 6002

Write the words.

13. 8335 14. 1900 15. 3612 16. 2073
13. eight thousand three hundred thirty-five
14. one thousand nine hundred
15. three thousand six hundred twelve
16. two thousand seventy-three

LESSON ACTIVITY

Before Using the Pages

- Distribute the models for ones, tens, and hundreds. Have the children count to ten by ones, displaying one more model for ones as they state each number. Then have the children replace the 10 ones with 1 ten. Emphasize that 10 ones and 1 ten each name the same number.

Have the children count to one hundred by tens, displaying one more model for tens as they state each number. Then have the children replace the 10 tens with 1 hundred. Emphasize that 10 tens and 1 hundred each name the same number.

Have the children count by hundreds to nine hundred, displaying one more model for hundreds as they state each number. Have the children place one more model for hundreds with the other nine models for hundreds. Ask the children to suggest names for this amount and ways to represent it with a model.

Using the Pages

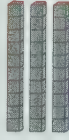
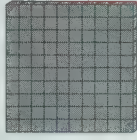
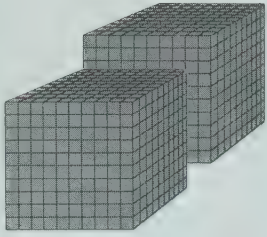
- Introduce the term *one thousand*. Emphasize that 1 thousand names the same number as 10 hundreds. Have the children point to the models for 10 hundreds and for 1 thousand. Tell them that 1 thousand can replace 10 hundreds. Have the children compare the models for thousands with the illustrations on page 202 and with the models for hundreds. Draw the children's attention to the numeral 1000. Point out that one thousand is the same as 1000 ones, 100 tens, or 10 hundreds.

Discuss the word name, numeral, and models on page 203 for 2137. Have the children point to and count the models representing each digit.

Working Together: Display models to represent each number as the children continue the table for Ex. 1. Emphasize the number of zeros shown in each numeral. Discuss the reason for the zeros in the answers for Ex. 3, 4, and 10-12. For Ex. 9-16, review how word names are written. Provide more examples, if necessary.

This shows two thousand one hundred thirty-seven.

10. two thousand three hundred twelve
11. four thousand one hundred
12. eight thousand eight hundred eighty-eight
13. nine thousand fifty-two
14. five thousand seventy



2 thousands

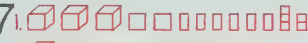
1 hundred

3 tens





7 ones

Two thousand one hundred thirty-seven can be shown like this

2137



Exercises

Use  for thousands,  for hundreds,  for tens, and  for ones.

Draw pictures to show each of these.

1. 3265
2. 1702
3. 2030
4. 4096
5. 1600

Write the numerals.

6. seven thousand four hundred eleven 7411
7. five thousand five 5005
8. three thousand three hundred forty 3340
9. six thousand eighty 6080

Write the words.

10. 2312
11. 4100
12. 8888
13. 9052
14. 5070

Long distances are measured in kilometres.

A kilometre is equal to 1000 metres.

Copy and complete this table.

15.	kilometres	1	2	?	?	5	6
	metres	1000	?	3000	4000	?	?
		2000		5000	6000		

203

RELATED ACTIVITIES

- Send children one at a time to place ten fingerprints on a piece of mural paper using finger paint, until one thousand fingerprints are shown. Draw lines to separate groups of 100 fingerprints. Similarly, have children help to draw one thousand faces or string one thousand beads (a marker can be placed after every 100 beads).

- Children may work in small groups in which one child writes a number on the board and each of the other children represents the number in a different way. An abacus, bundles of sticks, models used for the *Lesson Activity*, or a place-value chart and cutouts from page T361 as models could be used.

- A trundle wheel may be used to measure distances in kilometres near the school or on a class trip.





- Make an odometer with a stick and four rolls of paper each having the digits 0 to 9. Imagine trips to places that are familiar to the children. For each location have a child show the distance in kilometres on the odometer.



Exercises: Compare the illustrations for Ex. 1-5 and the models for the same numbers. Tell the children that the pictures they draw do not need to be elaborate.

To prepare for Ex. 15, display a metre stick. Have the children think of objects one metre long, then distances ten metres long, then one hundred metres long, and then one thousand metres long. Tell the children that *one kilometre* is the name for one thousand metres. Ask if they notice anything similar in the words *metre* and *kilometre*. Name one or two places that are about one kilometre from the school. Have children read and explain Ex. 15.

Assessment

Use  for thousands,  for hundreds,  for tens, and  for ones.

Draw pictures to show each of these.

1. 101
2. 2035

Write the numerals.

3. three thousand four 3004
4. seven thousand forty 7040

Write the words.

5. 4238 four thousand two hundred thirty-eight
6. 5200 five thousand two hundred

LESSON OUTCOME

Write the expanded form for numbers to 9999

Materials

models for thousands, hundreds, tens, and ones for each child; two numeral cards for each digit; a piece of fabric

Vocabulary

reverse

Prerequisite Skills

Write numerals and words for numbers to 9999; interpret place value for numbers to 9999

Checking Prerequisite Skills

Write the numerals.

1. two thousand fifty **2050**
2. one thousand one **1001**

Write the words.

3. 1300 4. 2022
- one thousand two thousand
- three hundred twenty-two

Expanded Form

Both flags show four thousand five hundred thirty-eight.



- Exercises:
1. $4000 + 100 + 40 + 8$
 2. $6000 + 900 + 20$
 3. $300 + 20 + 8$
 4. $8000 + 700$
 5. $3000 + 10 + 7$
 6. $9000 + 40$
 7. $800 + 60 + 4$
 8. $1000 + 5$
 9. $5000 + 800 + 2$

Working Together

Show each number in expanded form.

Example:

$$4538 = 4000 + 500 + 30 + 8$$

$$7000 + 400 + 60 + 3 \quad 3000 + 500 + 80$$

1. 7463 2. 3580
3. 8307 4. 6060

$$8000 + 300 + 7 \quad 6000 + 60$$

Show each number in standard form.

5. $4000 + 900 + 10 + 2$ **4912**
6. $1000 + 50 + 4$ **1054**
7. $9000 + 200$ **9200**
8. $2000 + 4$ **2004**
9. $700 + 10 + 1$ **711**

10. $7000 + 600 + 20 + 8$ **7628**
11. $7600 + 28$ **7600 + 20 + 8**
12. $5000 + 900 + 60$ **5960**
13. $5900 + 60$ **5900 + 900 + 60**
14. $5000 + 960$ **5960**
15. $8000 + 500 + 30 + 1$ **8531**
16. $8000 + 500 + 31 **8500 + 30 + 1**$
17. $8500 + 30 + 1 **8531**$

Exercises

Write each number in expanded form.

1. 4148 2. 6920 3. 328
4. 8700 5. 3017 6. 9040
7. 864 8. 1005 9. 5802

Write each number in standard form.

10. $7000 + 400 + 50$ **7450**
11. $4000 + 800 + 4$ **4804**
12. $1000 + 90$ **1090**
13. $500 + 60 + 3$ **563**
14. $6000 + 300 + 50 + 8$ **6358**
15. $3000 + 200$ **3200**
16. $2000 + 8 + 1$ **2081**

LESSON ACTIVITY

Before Using the Pages

- Before the lesson, write the following on the board several times.

_____ = _____ thousands
 _____ hundreds
 _____ tens
 _____ ones

Begin by writing 2796 in the first blank. Have the children select models for thousands, hundreds, tens, and ones to represent this number. Ask for and record, in turn, the number of thousands, hundreds, tens, and ones. Emphasize that 2796 names the same number as 2 thousands 7 hundreds 9 tens 6 ones. Repeat this with a few examples including some with zero in one or more places.

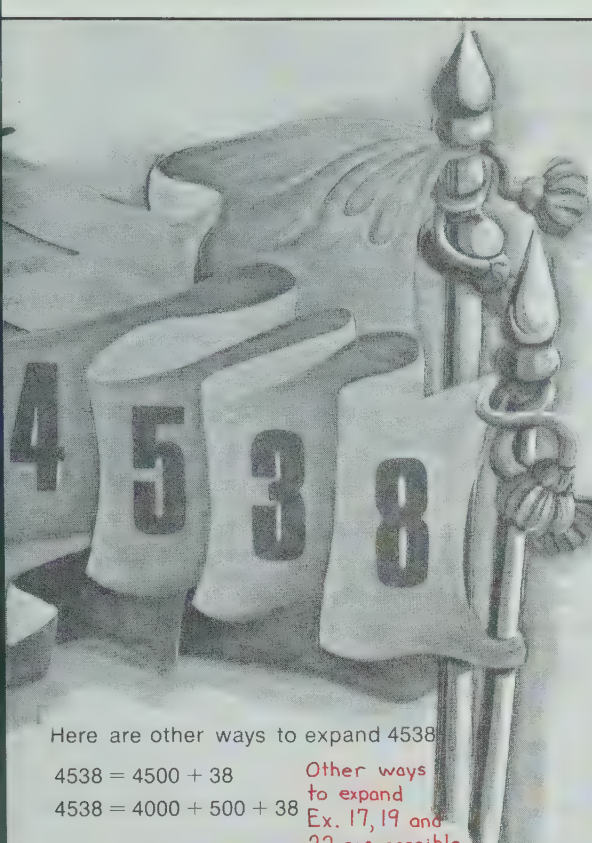
Then write the numeral and have children fill in the other blanks without using models.

Using the Pages

- Have the children compare the flags on pages 28-29 with the flags on these pages. Ask in what way the numerals on the flags on pages 204-205 are different from those on pages 28-29. Point out that the red flag could be folded as on page 205 to show the same numerals as there are on the yellow flag. Emphasize that these are different ways of naming the same number.

Working Together: Read the worked example and compare with the flags. Review the term *expanded form*. Ask for reasons for using the symbol $+$ in the expanded form. Develop that 4538 equals the sum of 4000, 500, 30, and 8. Have the children complete Ex. 1-4. Emphasize how the expanded form is written when there is a zero in the numeral.

Review the term *standard form*. Remind the children to think about the meaning of each digit in the standard form for each of Ex. 5-9. Provide more examples, if necessary.



Here are other ways to expand 4538

4538 = 4500 + 38
 4538 = 4000 + 500 + 38
 Expand each of these in three different ways.

- | | | |
|----------|----------|----------|
| 17. 7628 | 18. 5960 | 19. 8531 |
| 20. 4095 | 21. 1803 | 22. 9712 |
- Write each number in standard form.
- | | |
|---------------------|-------------------------|
| 23. 4000 + 404 | 24. 400 + 40 + 4 |
| 25. 4040 + 4 | 26. 4000 + 440 |
| 27. 4000 + 4 | 28. 4000 + 44 |
| 29. 4000 + 400 + 40 | 30. 4000 + 400 + 4 |
| 20. 4000 + 90 + 5 | 21. 1000 + 800 + 3 |
| 4090 + 5 | 1800 + 3 |
| 4000 + 95 | 1000 + 803 |
| | 22. 9000 + 700 + 10 + 2 |
| | 9700 + 12 |
| | 9000 + 700 + 12 |

Nan was born in 1971. She says she can tell how old she is in any year this way:

1975 → 1 + 9 + 7 + 5
 → 22 → 2 + 2 → 4

She was 4 years old in 1975.

1. Will this always work for Nan? **no**

Reverse the order of the digits in 1991 and get 1991

2. For what other years can this be done? **Many answers are possible. Some are given. Turn the year 1771, upside down and get 1961**

3. Find another year for which this can be done.

1111, 3333, 8118, 1881, 9116, 6119, 1691, 1001, 8008, 9006, 6009

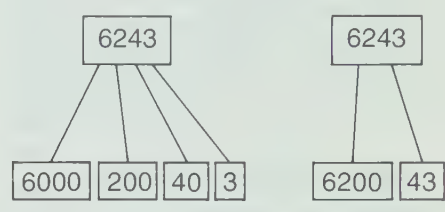
try this

RELATED ACTIVITIES

- Adapt the third activity suggested on page T 31 to include thousands and prepare a card for each of 1000, 2000, 3000, . . . , 9000.
- Pairs of cards similar to the following could be used for the game "Concentration" on page T349.

5000 + 400 + 3	5403
----------------	------

- Children may enjoy making mobiles similar to the following to illustrate different ways to expand a numeral.



- A work sheet similar to the following could be used.

Match names for the same number.

5673	4000 + 9
3021	5000 + 600 + 70 + 3
4009	3000 + 20 + 1

- Children may be interested in searching for patterns in a chart made with the answer for Ex. 1 of Try This. A child could prepare a similar chart for the year he/she was born.

Exercises: Compare the worked example preceding Ex. 17-22, the flags, and the worked example on page 204. Point out that the worked example on page 205 shows other ways of expanding 4538, but that these are not the usual expanded form. Have the children think of other ways of expanding 4538. Children may enjoy comparing different answers for Ex. 17, 19, and 22. Ex. 23-30 require the children to think carefully about the place value of each digit.

This: Have a child write the year he/she was born on the board. Follow the pattern used for Ex. 1. Discuss interesting points that develop. Repeat a few times. Read Ex. 1.

Ask if any child has a reversible jacket. If possible, show it to the children, and discuss the meaning of reversible and reverse. Display a piece of fabric, and ask a child to point to the reverse side. Have two children stand side by side. Then tell them to reverse their positions. Represent a two-digit number with two numeral cards. Ask a child to reverse the order of the digits. Do the same with a four-digit number. Read Ex. 2.

Put a numeral card on the board. Ask a child to turn it upside down. Discuss what happens to the numeral. Try this with each of the numeral cards. Tape four numeral cards together to form 1279. Ask a child to turn it upside down. Then use the numerals 1661 and 1961. Read Ex. 3.

Assessment

Write each number in expanded form.

1. 3333 2. 3030
 3000 + 300 + 30 + 3 3000 + 30

Write each number in standard form.

3. 4000 + 200 + 5 4. 5000 + 1
 4205 5001

Expand each of these in three different ways.

5. 2022 6. 1111
 2000 + 20 + 2 1000 + 100 + 10 + 1
 2000 + 22 1000 + 100 + 11
 2020 + 2 1000 + 111
 Other ways are possible.

LESSON OUTCOME

Regroup thousands, hundreds, tens, and ones

Materials

models for thousands, hundreds, tens, and ones, and copies of page T 365 for each child

Vocabulary

cross-country race, history

Prerequisite Skills

Interpret place value in numerals to 9999; regroup with three-digit numbers

Checking Prerequisite Skills

Complete the following.

- 4301 =
4 thousands 3 hundreds
0 tens 1 one
- one thousand eleven =
1 thousand 0 hundreds
1 ten 1 one

Write each number in standard form.

- 6 thousands 4 ones 6004
- 7 thousands 2 hundreds 7200

Background

The exercises in this lesson enable children to practice the kinds of regrouping performed in Unit 12 for addition and in Unit 13 for subtraction.

Regrouping

The cross-country race covered fifteen hundred metres.



Fifteen hundred can be shown like this

1500

Another name for fifteen hundred is one thousand five hundred.

Working Together

Write the numerals.

- nineteen hundred 1900
- ten hundred fifty 1050
- twenty-three hundred five 2305
twelve hundred fifty

Write the words

without using *thousands*.

Example: For 1200, write
twelve hundred.

- 1250
- 2500

Write each number in standard form.

- 1985
- 2634
- 1037

thousands	hundreds	tens	ones
	19	8	5
1	16	2	14
	9	13	7

Regroup to show 10 more hundreds.

Example: For 2534,

- 2560
- 2000

Regroup to show 10 more tens.

Example: For 1056, think

10 hundreds, 5 tens

and show 1056.

- 2025
- 1004

Regroup to show 10 more ones.

Example: For 1004, think

100 tens, 4 ones

and show 1004.

- 1000
- 1305

206

LESSON ACTIVITY

Before Using the Pages

- Have the children use models to show 1 thousand, 2 hundreds, 3 tens, and 12 ones. Ask for and record on a place-value chart the number of thousands, hundreds, tens, and ones. Ask what regrouping must be done to prepare for writing the number in standard form. Lead the children to suggest regrouping 10 of the ones as 1 ten. Have the children regroup their models. Then record the regrouping on the place-value chart. Emphasize that these are different ways of naming the same number. Use a similar procedure for other examples such as 1 thousand, 15 hundreds, 10 tens, and 7 ones.
- Reverse the procedure and have the children select models for 1 thousand, 2 hundreds, 3 tens, and 5 ones. Ask for and record on a place-value chart the number of thousands, hundreds, tens, and ones. Have the children regroup their

models to show this number with 10 more ones. Record regrouping. Repeat the procedure to show the number with 10 more tens, and then with 10 more hundreds. Use similar procedure with other examples such as 1 thousand, 4 hundreds, and 7 tens.

Using the Pages

- Read the first statement in the worked example. Ask for record on the place-value chart on the board, the number of thousands, hundreds, tens, and ones for 1500. Ask children to give a regrouping that will show 1500 without using thousands. Record the regrouping. Relate the word names for 1500 on page 206. Emphasize that these both name the same number. Tell the children that "fifteen hundred" is the way dates in history are stated. Ask children to state the date for the current year.

Working Together: After discussing each worked example, have the children complete the corresponding exercises.

Exercises

Write each number in standard form.

	thousands	hundreds	tens	ones
1505 1.		15	0	5
2237 2.	1	12	2	17
1433 3.		13	13	3
1602 4.	1	5	9	12
1042 5.		9	14	2
2006 6.	1	19	10	6

Regroup to show 10 more hundreds.

7. $2\overset{1}{\cancel{6}}24$ 8. $2\overset{1}{\cancel{2}}00$ 9. $2\overset{1}{\cancel{0}}87$

Regroup to show 10 more tens.

10. $16\overset{5}{\cancel{4}}5$ 11. $10\overset{9}{\cancel{7}}8$ 12. $20\overset{10}{\cancel{0}}0$

Regroup to show 10 more ones.

13. $135\overset{4}{\cancel{4}}$ 14. $190\overset{89}{\cancel{3}}$ 15. $200\overset{199}{\cancel{0}}$

Regroup to show 10 more ones.

Then regroup to show 10 more tens.

Example: For 1325, show $13\overset{115}{\cancel{2}}5$.

16. $14\overset{10}{\cancel{4}}6$ 17. $10\overset{9}{\cancel{0}}\overset{12}{\cancel{3}}\overset{11}{\cancel{2}}\overset{2}{\cancel{1}}5$ 18. $17\overset{12}{\cancel{3}}0$

Here are some important dates in history. Write the numerals.

- 19. fourteen hundred ninety-two 1492
- 20. seventeen hundred fifty-nine 1759
- 21. eighteen hundred sixty-seven 1867
- 22. nineteen hundred sixty-nine 1969
- 23. fifteen hundred thirty-four 1534
- 24. nineteen hundred forty-nine 1949
- 25. nineteen hundred eighteen 1918

Copy and complete each addition table.

1.

+	0	1	2	3	4	5	6	7	8	9
0	0	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9	10
2	2	3	4	5	6	7	8	9	10	11
3	3	4	5	6	7	8	9	10	11	12
4	4	5	6	7	8	9	10	11	12	13
5	5	6	7	8	9	10	11	12	13	14
6	6	7	8	9	10	11	12	13	14	15
7	7	8	9	10	11	12	13	14	15	16
8	8	9	10	11	12	13	14	15	16	17
9	9	10	11	12	13	14	15	16	17	18

2.

+	4	2
5	9	7
1	5	3

Think

$4 + 4 = 9$

$5 + 4 = 9$

3.

+	7	9	8
6	13	15	14
7	14	16	15
5	12	14	13

Think

$6 + 7 = 13$

$6 + 7 = 13$

4.

+	9	7	8	6
7	16	11	14	15
6	15	10	13	14
3	12	7	10	11
9	18	13	16	17
4	13	8	11	12
8	17	12	15	16

Think

$9 + 4 = 13$

$9 + 4 = 13$

KEEPING SHARP

RELATED ACTIVITIES

- The children may wish to write a story using dates written as numerals and four-digit numbers written as words.
- Regrouping could be illustrated with an abacus or a place-value pocket chart. The children might be given a number and asked to regroup to show 10 more ones, tens, and/or hundreds, or to show the number without thousands.
- You may prepare an addition table similar to the ones in *Keeping Sharp*. Many variations are possible. It could give all the addends in any order or some sums and addends. (Check to be certain that the table can be completed with the numbers given.)
- The children may enjoy the challenge of creating an addition table for others to complete.
- Searching for patterns in the first table of *Keeping Sharp* would reinforce addition facts and patterns. The children may enjoy showing on a bar graph or a line graph the number of times each numeral appears in the table. These could be displayed.

Provide similar examples, if necessary. For each regrouping, emphasize that different ways of naming the same number are shown.

For the worked example preceding Ex. 11 and 12, point out that since there are 0 hundreds, each thousand is thought of as 10 hundreds to allow regrouping to show 10 more tens. For the worked example preceding Ex. 13 and 14, lead the children to understand that since there are 0 tens and 0 hundreds, the 1 thousand is thought of as 100 tens to allow regrouping to show 10 more ones.

Exercises: For Ex. 1-6, remind the children to determine which numbers must be regrouped before writing the number in standard form.

Discuss each step of the worked example for Ex. 16-18.

Keeping Sharp: You may wish to use this table to demonstrate how to complete the tables. Provide each child with a copy of page T 365 for the tables.

+	2	
	4	6
		7

Assessment

Write each number in standard form.

	thousands	hundreds	tens	ones
1.	1	4	19	0
2.		17	0	12

1590

1712

Regroup to show 10 more ones. Then regroup to show 10 more tens.

3. 4372 4. 9042

3. $4\overset{16}{\cancel{3}}\overset{2}{\cancel{7}}2$

Write the numeral.

5. sixteen hundred eight

4. $16\overset{13}{\cancel{0}}\overset{89}{\cancel{4}}2$

1608

LESSON OUTCOME

Compare and order numbers to 9999

Materials

numeral cards for 0 to 9

Vocabulary

championship, Magic Square

Prerequisite Skills

Read and write standard numerals for numbers to 9999; interpret place value for four-digit numerals

Checking Prerequisite Skills

Write the standard numeral.

1. four thousand seven **4007**

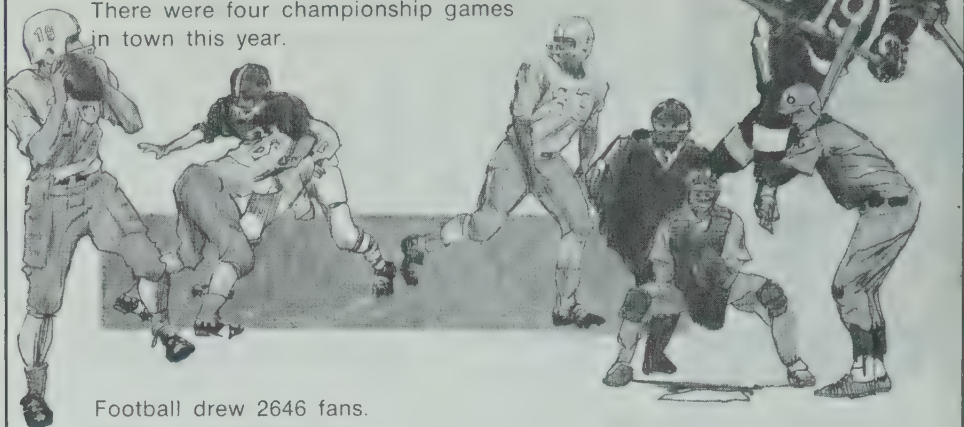
2. one thousand eight hundred eighty **1880**

Complete the following.

3. $4040 = \underline{4}$ thousands $\underline{0}$ hundreds
 $\underline{4}$ tens $\underline{0}$ ones

Comparing and Ordering Numbers

There were four championship games in town this year.



Football drew 2646 fans.
Baseball drew 1847 fans.
Hockey drew 2651 fans.
Basketball drew 2495 fans.

Which championship game was seen by the greatest number of people?

2 thousands are more than 1 thousand.

6 hundreds are more than 4 hundreds.

5 tens are more than 4 tens.

2 6 4 6
~~1~~ 8 4 7
2 6 5 1
2 4 9 5

2 6 4 6
~~1~~ 8 4 7
2 6 5 1
2 ~~4~~ 9 5

2 6 ~~4~~ 6
~~1~~ 8 4 7
2 6 5 1
2 ~~4~~ 9 5

The greatest number of people, 2651, watched the hockey championship.

Working Together

Which number in each pair is greater?

List each group of numbers in order from least to greatest.

1. **3254** vs **3654**
2. **1284** vs **1281**
3. **4012**, **4120**, **4102**
4. **5648**, **5486**, **5646**

208

LESSON ACTIVITY

Before Using the Pages

- Display four one-digit numeral cards to represent a four-digit number. Ask a child to change the positions of two cards to obtain a greater number. Continue this procedure until the children state that the number cannot be greater using those four digits. Ask the children to explain the reason for this statement. Explore their suggestions. Repeat this procedure with a few examples.

Reverse the procedure and have the children change the positions of two cards at a time to obtain a lesser number until they state that they have found the least number possible using the digits given. Explore the reasons for this. Write this number on the board.

Remove one of the cards. Have children change the positions of two cards at a time until the greatest number possible is found. Write this number beside the other number. Ask for the greater of these two numbers. Discuss

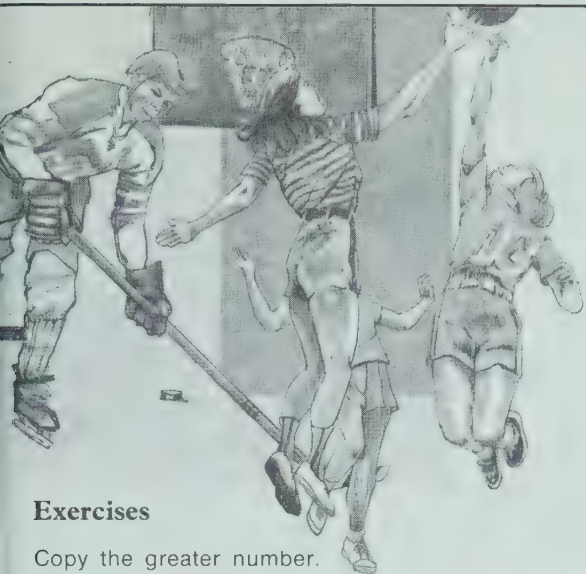
the choice. Develop that any four-digit number is greater than any three-digit number.

Using the Pages

- Use the picture to introduce the worked example. Read the question for the worked example. Have the child compare the number of thousands for the four numbers. Establish that 1847 has fewer thousands than any of the other numerals. Explore the reason for eliminating 1847. Develop the fact that since 1847 has fewer thousands, it is less than the other three numbers regardless of the number of hundreds, tens, or ones in any of the numerals. Use a similar procedure to compare the number of hundreds and then the number of tens. Discuss the answer for the worked example.

Provide similar examples including some with numbers having a different number of digits, for example, 8032, 3208, and 28.

Emphasize that the thousands are compared first, then the hundreds, then the tens, and then the ones.



Exercises

Copy the greater number.

1. 3561 or 5163
2. 2039 or 2093
3. 8206 or 859
4. 5126 or 5261

Write $>$ or $<$ to make a true statement.

Examples: $7530 > 7350$ shows 7530 is greater than 7350. $7350 < 7530$ shows 7350 is less than 7530.

5. $4861 \bigcirc 6841 <$
6. $5210 \bigcirc 597 >$
7. $1737 \bigcirc 1731 >$
8. $2409 \bigcirc 2490 <$
9. $8573 \bigcirc 8753 <$
10. $3649 \bigcirc 3496 >$

List these numbers in order from least to greatest. 11. 4956, 5649, 5694, 5964

11. 5964
4956
5694
5649
12. 2233 3223
3232 233
2323 2332
223 3322

12. 223, 233, 2233, 2323, 2332, 3223, 3232, 3322

This is a Magic Square.

Add across, down, or diagonally and get 15.

1. Try it.

4	9	2	→ 15
3	5	7	→ 15
8	1	6	→ 15
↓ 15	↓ ?	↓ 15	↘ 15

2. Complete this Magic Square so that all sums are 18.

7	7	?			4
?	?	?	3	6	9
?	5	?	8		5

3. Try to arrange the nine numbers 0, 1, 2, 3, 4, 5, 6, 7, 8 to make a Magic Square.

Different Magic Squares are possible. One is given.

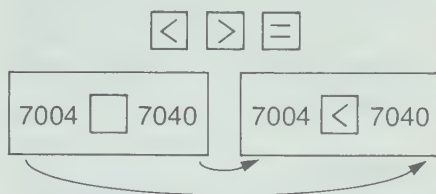
8	1	6
3	5	7
4	9	2

try this

209

RELATED ACTIVITIES

• Prepare cards similar to the following.



Have the children select a symbol to complete the number sentence, and then check the answer on the back of the card.

• You may prepare envelopes with four of the numeral cards for 0 to 9. Have the children form as many four-digit numerals as possible and record each. Then have the children order the numbers from least to greatest.

• The children may use the numeral cards described in the above activity to obtain the greatest (least) four-digit number possible.

• Children may enjoy creating their own Magic Squares for themselves or for other children to solve.

• Adapt the second activity on page T 35 to be used for four-digit numerals. Make a thousands' place on the pocket charts and three more numeral cards. Deal four cards to each of the three players. The thirteenth card is set aside face down.

Working Together: Emphasize comparing the digits from left to right for Ex. 1 and 2. For Ex. 3 and 4, ensure that the children understand that they are asked to order the numbers from least to greatest, not from greatest to least.

Exercises: Read the worked examples on page 209 to review the symbols $>$ and $<$. Thinking of associating the larger part of the symbol with the greater number and the smaller part of the symbol with the lesser number may help the children remember the meaning of these symbols. For Ex. 12, remind the children to compare the numbers of digits and then to compare the digits from left to right.

This: Explain that a Magic Square is a square in which the sums of the numbers across, down, and diagonally are the same. Have the children complete Ex. 1 and discuss the square as a Magic Square. For Ex. 2, explore how to find the missing numbers. Point out that all but one number in a line must be known in order to find the last. Some children may require help in determining the order of the steps for Ex. 2. Children may enjoy the challenge of finding a

solution for Ex. 3. When they have had an opportunity to explore Ex. 3, those with answers may wish to display their Magic Squares and compare solutions.

Assessment

Copy the greater number.

1. 2764 or 2674 2764
2. 1012 or 1102 1102

Write $>$ or $<$ to make a true statement.

3. 2123 $<$ 2312
4. 610 $<$ 6001

List these numbers in order from least to greatest.

5. 5021, 5201, 5120, 5012, 521, 2105, 5102
6. 4003, 3004, 4030, 3040, 430, 3400
5. 521, 2105, 5012, 5021, 5102, 5120, 5201
6. 430, 3004, 3040, 3400, 4003, 4030

LESSON OUTCOME

Read and write numerals for fractions for parts of sets (halves, thirds, fourths, tenths); solve related word problems

Materials

counters (golf tees, buttons) of different colors for each child

Vocabulary

sets

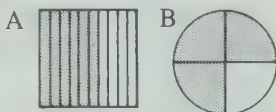
Prerequisite Skills

Read and write numerals for fractions for parts of a whole

Checking Prerequisite Skills

Match each fraction with a picture.

1. $\frac{1}{2}$ C



2. $\frac{2}{3}$ D

3. $\frac{3}{4}$ B

4. $\frac{6}{10}$ A



Background

On pages 36-39, fractions are used to describe parts of a whole. The parts of a whole must be equal. On pages 210-211, fractions describe parts of a set. The parts of a set are not necessarily the same.

LESSON ACTIVITY

Before Using the Pages

- Display three yellow counters and one red counter. Ask for and record on the board: the number of counters altogether; the number of yellow counters; the fraction that shows how many of the counters are yellow. Discuss the meaning of the lower and the upper numerals. Establish that the lower numeral shows the number of counters altogether and the upper numeral shows the number of yellow or special counters.

Repeat this procedure with a few other examples showing halves, thirds, or tenths.

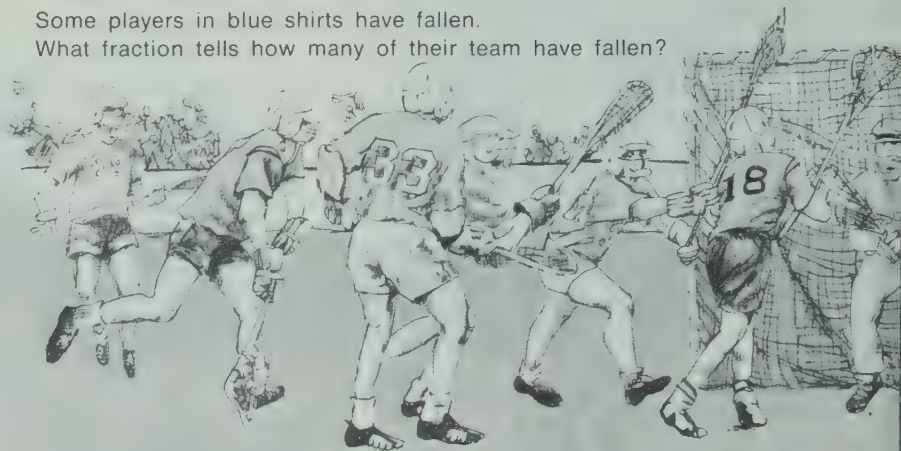
- Reverse the procedure and have the children select counters to show two-thirds. Discuss their selections in terms of the number of counters altogether and the number of special counters.

Repeat this with a few other examples for halves, thirds, fourths, or tenths.

Fractions for Parts of Sets

Some players in blue shirts have fallen.

What fraction tells how many of their team have fallen?



10 players
in blue shirts.

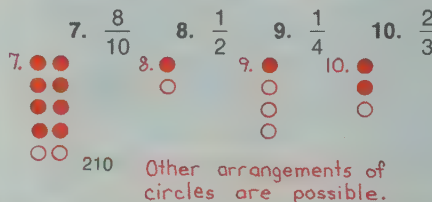
3 have fallen.

$\frac{3}{10}$ of the team
has fallen.

Working Together

- How many circles? 10
- How many shaded? 7
- What fraction tells how many are shaded? $\frac{7}{10}$
- How many circles? 4
- How many shaded? 2
- What fraction tells how many are shaded? $\frac{2}{4}$

Draw sets of circles and shade to show these fractions.

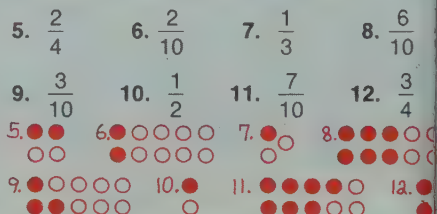


Exercises

Write the fraction that shows how many of each set are shaded.



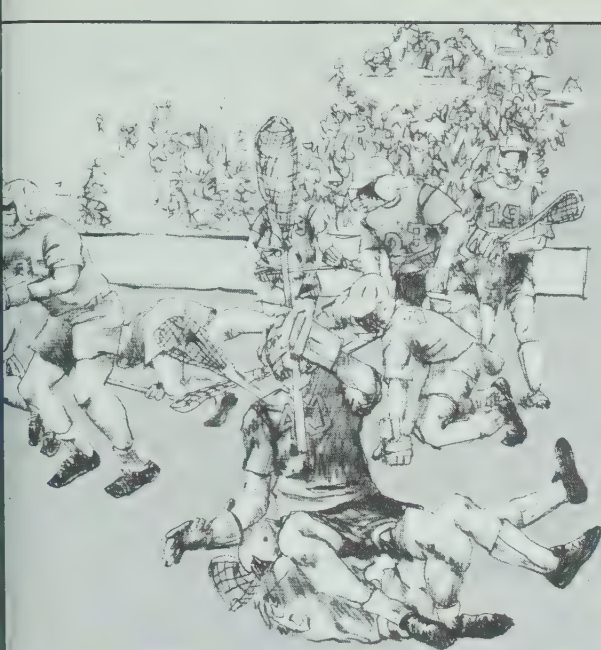
Draw sets of circles and shade to show these fractions.



- Ask the children to name examples of halves, thirds, fourths or tenths that they see in the classroom. Have them give a fraction to describe each example they name. Develop examples where the parts of a set are not necessarily the same. For example, one of three books is blue, one-third of the books are blue regardless of the size or shape of the books.

Using the Pages

- Discuss the game shown in the picture. Ask for the color of the shirts worn by each team. Read the question for the worked example. Have the children point to and count the players wearing blue shirts, and then the players who have fallen. Discuss the fraction that indicates three of ten. Ask a child to read this fraction. Point out that the lower numeral shows the number of players being considered and the upper numeral shows the number of players who have fallen.



Answer each question.

13. A hockey game has 3 periods. When 2 periods are played, what fraction tells how much of the game has been played? $\frac{2}{3}$
14. A basketball game has 4 quarters. When 2 quarters are played, what fraction tells how much of the game has been played? $\frac{2}{4}$
15. In baseball, 2 teams bat each inning. When 1 team is done batting, what fraction tells what part of the inning is over? $\frac{1}{2}$
16. In ten-pin bowling, when 8 pins are knocked down, 2 pins are left standing. What fraction tells how many pins are left standing? $\frac{2}{10}$
17. When 9 pins are knocked down, 1 pin is left standing. What fraction tells how many of the ten pins are left standing? $\frac{1}{10}$

Add.

- | | |
|--|--|
| 1. $\begin{array}{r} 25 \\ + 34 \\ \hline 59 \end{array}$ | 2. $\begin{array}{r} 557 \\ + 30 \\ \hline 587 \end{array}$ |
| 3. $\begin{array}{r} 512 \\ + 134 \\ \hline 646 \end{array}$ | 4. $\begin{array}{r} 426 \\ + 421 \\ \hline 847 \end{array}$ |
| 5. $\begin{array}{r} 870 \\ + 13 \\ \hline 883 \end{array}$ | 6. $\begin{array}{r} 23 \\ + 64 \\ \hline 87 \end{array}$ |
| 7. $\begin{array}{r} 441 \\ + 205 \\ \hline 646 \end{array}$ | 8. $\begin{array}{r} 36 \\ + 3 \\ \hline 39 \end{array}$ |
| 9. $\begin{array}{r} 133 \\ + 56 \\ \hline 189 \end{array}$ | 10. $\begin{array}{r} 631 \\ + 24 \\ \hline 655 \end{array}$ |

Subtract.

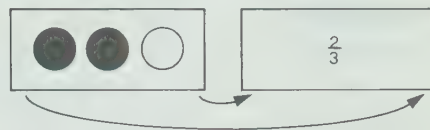
- | | |
|---|---|
| 11. $\begin{array}{r} 45 \\ - 32 \\ \hline 13 \end{array}$ | 12. $\begin{array}{r} 782 \\ - 142 \\ \hline 640 \end{array}$ |
| 13. $\begin{array}{r} 173 \\ - 41 \\ \hline 132 \end{array}$ | 14. $\begin{array}{r} 988 \\ - 210 \\ \hline 778 \end{array}$ |
| 15. $\begin{array}{r} 88 \\ - 62 \\ \hline 26 \end{array}$ | 16. $\begin{array}{r} 449 \\ - 18 \\ \hline 431 \end{array}$ |
| 17. $\begin{array}{r} 356 \\ - 203 \\ \hline 153 \end{array}$ | 18. $\begin{array}{r} 29 \\ - 7 \\ \hline 22 \end{array}$ |
| 19. $\begin{array}{r} 697 \\ - 42 \\ \hline 655 \end{array}$ | 20. $\begin{array}{r} 275 \\ - 154 \\ \hline 121 \end{array}$ |

KEEPING SHARP

211

RELATED ACTIVITIES

- Encourage the children to be aware of fractions in everyday situations. You could provide an opportunity for children to report the examples they have found.
- Prepare flash cards as shown with a picture of part of a set on one side and a fraction on the other.



Children may work individually or in pairs for practice. A small group of children can play a game with a leader showing a card. The first player who answers correctly takes the card. When all the cards are taken, the player with the most cards becomes the next leader.

- Adapt the card game on page T 39. One of the pair of cards shows a picture for a fraction as part of a set and the other shows the corresponding fraction.
- The cards prepared for the game in the above activity may be used for the game "Concentration" on page T 349.
- The children may enjoy demonstrating fractions. For example, they could show one-fourth in groups of four with one in each group standing and the other three in the group sitting.
- Children could play the game "Show Me" in which one child names a fraction and the others illustrate the fraction using counters.

Working Together: Ex. 1-6 review the significance of the upper and the lower numerals of a fraction. The sub-skills dealt with are:
count the circles;
count the shaded circles;
give the fraction that shows how many of the circles are shaded.

For Ex. 1-6, have the children determine the number of circles indicated and then the number of circles that are shaded. Have children explain Ex. 7-10 by stating the number of circles and then the number of shaded circles. Provide similar examples, if necessary.

Exercises: For Ex. 1-4, remind the children to think about the meaning of the lower and the upper numerals as they complete the exercises. Children may wish to share their drawings for Ex. 5-12. Have the children answer Ex. 13-17 in a sentence. Children may benefit from drawing a picture for Ex. 16 and 17.

Keeping Sharp: These exercises review addition and subtraction with no regrouping. However, remind the children to begin with the ones, then the tens, and then the hundreds. The review prepares the children for addition in Unit 12 and subtraction in Unit 13.

Assessment

Write the fraction that shows how many of each set are shaded.

1. $\frac{1}{2}$
2. $\frac{3}{4}$
3. $\frac{1}{2}$

Draw sets of circles to show these fractions.

4. $\frac{1}{2}$
5. $\frac{1}{4}$
6. $\frac{7}{10}$

OBJECTIVE

Complete and solve incomplete word problems

Materials

a box of crayons

Vocabulary

information

Background

These problems involve deciding what information is missing, supplying it, and completing the problems. A different answer is possible for each completion in the hypothetical form of "if . . . , then . . .". Facts given in the problems guide the completion. To avoid unreasonable statements the completing facts are limited. Also, the question determines the operation and the wording of the answer. The concept of hypothetical statements can be difficult for children. They may benefit from hearing and using it in a variety of situations.

RELATED ACTIVITIES

- Have the children create problems with missing information for others to solve. Pictures may help children think of topics for their problems.

More Information Needed

Sometimes more information is needed to solve a problem.

Example: 13 boys and all the girls were outdoors at recess. How many children were outdoors at recess?

To solve this problem, you need to know the number of girls.

If there were 17 girls, then

$$13 + 17 = 30 \text{ and}$$

30 children were outdoors at recess.

Answers will vary.

Tell what information is needed. Make up numbers for the missing information and solve the problems.

1. Ralph has a plant that is 58 cm tall. Robbie's plant is shorter. How much taller is Ralph's plant?
2. One bag holds 28 kg of sand. The other bag is heavier. How many kilograms of sand are there in all?
3. Pam had \$5.00. She bought a yellow scarf. How much money does she have left?
4. Teresa left the room. She came back at 2:45. How long was she gone?
5. The temperature is 11°C. One hour ago it was colder. How much warmer is it now?
6. I have 97 toy blocks. I want to build two houses. How many more blocks do I need?
7. Jack had some money. He bought a belt for \$1.67. How much does he have left?
8. Each jug of cider holds 5 l. How many litres of cider are there in all?
9. Dean can touch a mark 2 m high. Craig cannot reach that high. How much higher can Dean reach than Craig?
10. Each side of a building is 10 m long. How far must Kate walk to walk around the building?

PROBLEM SOLVING

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LESSON ACTIVITY**Before Using the Page**

- Display a small box of crayons in such a way that the children cannot see how many crayons are in the box. Give six of the crayons to a child. Ask how many crayons are left in the box. If a child answers the question, ask how he/she obtained the answer. In the discussion, it will become apparent that they must know the number of crayons that were in the box originally before answering the question. Probably the children will realize that they do not have enough information to solve the problem, and they will ask how many crayons were in the box. Have them complete the problem stating, "If there were ____ crayons, then there would be ____ crayons left." The question you ask requires the operation of subtraction. Point out that any sensible completion is possible as a make-believe situation. Ask if it is possible to state, "If there were nine thousand crayons,"

Using the Page

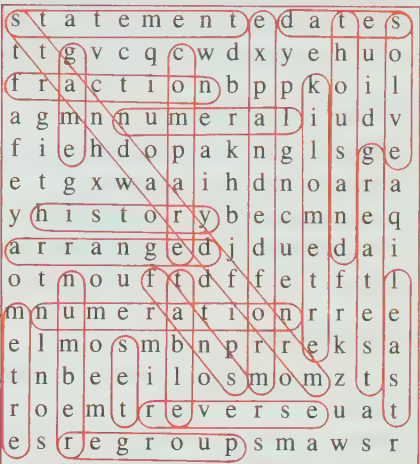
- Read the worked example on the page. Emphasize that "there were 17 girls" is only a possibility because problem does not state how many girls there were. Ask children to think of other possibilities.
- Discuss the meaning of the title and its connection with worked example. Ask the children what they expect in problems.
- The problems could be approached in a variety of ways. Children may enjoy creating many possible solutions for each problem. They may wish to find only one solution for each. Some may require guidance individually or in a small group. Others may like to work together to share their ideas.

OBJECTIVE

Demonstrate an understanding of the concepts and skills presented in this unit

RELATED ACTIVITIES

- Children may enjoy reviewing the vocabulary of Unit 11 with the following word search puzzle.



Can you find these words in the puzzle?

- | | | |
|---------------|------------|-----------|
| arranged | history | reverse |
| compare | kilometre | set |
| dates | least | solve |
| expanded form | metre | standard |
| fans | number | form |
| fraction | numeral | statement |
| game | numeration | table |
| greatest | regroup | thousand |

Checking Up

Write the numerals.

- two thousand one hundred forty-six **2146**
- five thousand fourteen **5014**
- three thousand six hundred fifty **3650**
- seven thousand twenty **7020**
- four thousand two hundred three **4203**
- one thousand seven **1007**

Write the words.

- 6342
- 3005
- 5701
- 4086

Write each number in expanded form.

- 2562 **$2000+500+60+2$**
- 1073 **$1000+70+3$**
- 8020 **$8000+20$**
- 7109 **$7000+100+9$**

Write each number in standard form.

- $3000 + 400 + 30 + 8$ **3438**
- $1000 + 300 + 5$ **1305**
- $4000 + 40 + 1$ **4041**
- $2000 + 800 + 10$ **2810**

Write the number that completes each sentence.

- 1325 is equal to **13** hundreds, 2 tens, 5 ones.
- 1738 is equal to 1 thousand, 6 hundreds, **3** tens, 8 ones.

Copy the greater number.

- 2348 or **2368**
- 4646** or 4466
- 1098 or **1890**

Write > or < to complete each sentence.

- 3621 **>** 3619
- 2357 **<** 2753

List these numbers in order from least to greatest.

- 3441, 4341, 3414, 413, 3411, 4431
413, 3411, 3414, 3441, 4341, 4431

Write the fraction that shows how many of each set are shaded.

- $\frac{3}{4}$
- $\frac{7}{10}$

Skills	Exercises	Related Pages
Write numerals for words	1-6	T 222-T 223
Write words for numerals	7-10	T 222-T 223
Change standard to expanded form	11-14	T 224-T 225
Change expanded to standard form	15-18	T 224-T 225
Group	19-22	T 226-T 227
Compare numbers	23-27	T 228-T 229
Order numbers	28	T 228-T 229
Write fractions for parts of sets	29, 30	T 230-T 231

Comments

Children write the numerals for Ex. 2-6 without zeros or the zeros incorrectly placed, or if they do not consider all zeros in Ex. 8-10, work with place-value charts and models. Thousands, hundreds, tens, and ones may be helpful. Writing each digit of the numerals for Ex. 11-18 on a place-value chart may show the change from standard to expanded form and from expanded to standard form.

Children may benefit from showing the regrouping in Ex. 19-22 with models, an abacus, or cutouts from copies of page T 361. Some children may miss one of the regroupings for Ex. 20, the regrouping of 1 thousand as 10 hundreds for Ex. 21, or the regrouping of 1 hundred as 10 tens for Ex. 22.

For Ex. 26 and 27, determine whether any errors are due to not understanding how to compare numbers or to forgetting the meanings of the symbols. Children who have difficulty with Ex. 28 may benefit from writing each of the numbers on a place-value chart.

Ensure that the children understand that the circles for each of Ex. 29 and 30 represent a whole set.

Unit 12 Overview

Addition

This unit serves to review and consolidate the addition concepts of the third year of the elementary mathematics program. Emphasis is given to mastering the standard algorithm with accuracy and reasonable efficiency.

Much of the unit is devoted to practice exercises. Addition with regrouping is reviewed and then extended to include four-digit sums. The addition skills are applied in a variety of word problems involving units of measurement for length and capacity, sums of money, and retail sales tax.

In the latter part of the unit, the previous work with column addition is extended to addition of three three-digit numbers.

Prerequisite Skills

- complete basic addition facts, sums to 18
- add three one-digit numbers
- add numbers with two regroupings, sums to 999
- add amounts of money with regrouping, sums to \$9.99
- interpret place value in numerals to 9999

Unit Outcomes

- add with regrouping, addends to 999, sums having up to four digits
- add amounts of money with regrouping, sums to \$49.99; solve related word problems
- add three numbers with regrouping, addends to 999, up to four-digit sums
- select the necessary information for solving a problem

Background

This unit follows sequentially from Unit 3 in which the children were introduced to regrouping in addition. Recall that the algorithm was presented in three stages. First, exercises involved only the regrouping of ones as tens. Later, exercises involved regrouping tens as hundreds. Finally, children were expected to complete exercises that involved two regroupings. A similar sequence reviews the algorithm in this unit.

Although no new mathematical concepts are introduced, children will encounter four-digit sums. In Unit 11 the numeration system was extended to the thousands' place. At that time, four-digit numerals were interpreted with and without using the term *thousand*. For example, 1362 can be thought of as "one thousand three hundred sixty-two" or as "thirteen hundred sixty-two". The addition of three-digit numbers with four-digit sums is a natural extension of this previous work with thousands. The addition is performed place by place as usual from right to left. The sum, found in terms of hundreds, can then be interpreted in terms of thousands. For instance, in the following exercise, adding the hundreds gives 13 hundreds. The sum can then be interpreted as "one thousand three hundred sixty-two".

	1	1	
	8	9	7
+	4	6	5
	1	3	6
			2

Recall that addition is a binary operation. That is, addition is performed with two numbers at a time, and the result is a third

number called the sum. The addition of a column of more than two numbers is, then, a sequence of binary operations in which each number is added to the result of a previous addition. For example, adding upward for the exercise shown, the addends and sums are $7 + 9 = 16$, $16 + 5 = 21$, and $21 + 4 = 25$. Checking addition by proceeding in the opposite direction, in this case, downward, involves different pairs of addends and sums: $4 + 5 = 9$, $9 + 9 = 18$, and $18 + 7 = 25$.

$$\begin{array}{r} 4 \\ 5 \\ 9 \\ + 7 \\ \hline 25 \end{array}$$

A similar procedure is involved in the addition of several numbers with two or more digits. For example, adding the numbers downward in the exercise shown, the addends and sums are $7 + 8 = 15$ and $15 + 2 = 17$. Then 17 ones are regrouped as 1 ten and 7 ones. Adding the tens downward, the addends and sums are 1 (regrouped) $+ 6 = 7$, $7 + 3 = 10$, and $10 + 5 = 15$. Regroup 15 tens as 1 hundred 5 tens. The sum may be checked by adding the columns in an upward direction.

$$\begin{array}{r} 1 \\ 67 \\ 38 \\ + 52 \\ \hline 157 \end{array}$$

Teaching Strategies

This unit contains much material which is suited to practice and reinforcement of the addition concepts of the third year of the elementary mathematics program. However, before assigning the practice exercises, there should be a review and reteaching of the concepts concerned. The diagnostic test included at the end of this overview can be administered prior to the work of this unit, to determine whether children have mastered each of the objectives of the previous addition unit. These objectives include basic addition facts (sums to 10), addition of three one-digit numbers, and addition with regrouping and with one or two regroupings (sums to 999). On the basis of their results, the children may be grouped for purposes of review and reteaching. Those children who have mastered the objectives of a particular set of practice exercises need only a short review before the exercises are assigned. For other children, concrete materials should be used by the teacher as well as the children, to develop understanding of the concepts involved, particularly in the regrouping of sums. In general, most children should have mastered the basic addition facts, and be able to state them from memory. Consequently, the use of manipulative materials to complete basic addition facts should no longer be necessary. For reteaching addition with regrouping, a different approach and alternative activities from those used in Unit 3 should be followed where possible. For example, the activity described on page T65 involving felt numerals on a flannel board is particularly helpful in reviewing addition with regrouping, and this approach can be used now if time did permit its use in Unit 3.

At the conclusion of the unit, the children may reasonably be expected to know the basic addition facts and be able to add two three-digit numbers without manipulative aids.

Materials

models for thousands, hundreds, tens, and ones for each child
containers marked in litres and millilitres
real money, play money, or copies of pages T 351 and T 352
cards showing the numerals 0 to 9
straight edge, a copy of one shape from page T 363, and pieces
of tracing paper for each child
large paper with the word story in *Before Using the Page* from
page T 254

Vocabulary

ancouver	rentals	millilitre (mL)
uvik	banded	brim
robisher Bay	stocked	round trip, km
askatoon	conservation officers	odometer
uebec	legend	sales tax table
. John's	sub-total, total	

Diagnostic Test

Part A examines basic addition facts for sums to 18 and the
addition of three one-digit numbers. For Part B the arrangement
of the exercises examines the addition algorithm for sums to 999
as follows.

Row 1 — no regrouping

Row 2 — regrouping ones as tens

Row 3 — regrouping tens as hundreds

Row 4 — two regroupings

Column 1 — two-digit numbers

Column 2 — three-digit numbers

Column 3 — amounts of money, sums to \$9.99

Part A

1. $\begin{array}{r} 9 \\ + 8 \\ \hline \end{array}$	2. $\begin{array}{r} 7 \\ + 5 \\ \hline \end{array}$	3. $\begin{array}{r} 6 \\ + 8 \\ \hline \end{array}$	4. $\begin{array}{r} 4 \\ + 7 \\ \hline \end{array}$
--	--	--	--

5. $\begin{array}{r} 2 \\ 3 \\ + 6 \\ \hline \end{array}$	6. $\begin{array}{r} 4 \\ 5 \\ + 3 \\ \hline \end{array}$	7. $\begin{array}{r} 7 \\ 9 \\ + 4 \\ \hline \end{array}$	8. $\begin{array}{r} 6 \\ 6 \\ + 9 \\ \hline \end{array}$
---	---	---	---

Part B

9. $\begin{array}{r} 45 \\ + 31 \\ \hline \end{array}$	10. $\begin{array}{r} 634 \\ + 312 \\ \hline \end{array}$	11. $\begin{array}{r} \$1.03 \\ + 1.45 \\ \hline \end{array}$
--	---	---

12. $\begin{array}{r} 26 \\ + 29 \\ \hline \end{array}$	13. $\begin{array}{r} 356 \\ + 237 \\ \hline \end{array}$	14. $\begin{array}{r} \$1.68 \\ + 2.28 \\ \hline \end{array}$
---	---	---

15. $\begin{array}{r} 74 \\ + 84 \\ \hline \end{array}$	16. $\begin{array}{r} 587 \\ + 292 \\ \hline \end{array}$	17. $\begin{array}{r} \$4.63 \\ + 1.43 \\ \hline \end{array}$
---	---	---

18. $\begin{array}{r} 75 \\ + 48 \\ \hline \end{array}$	19. $\begin{array}{r} 358 \\ + 445 \\ \hline \end{array}$	20. $\begin{array}{r} \$2.83 \\ + 4.17 \\ \hline \end{array}$
---	---	---

OBJECTIVE

Demonstrate competence in completing basic addition facts, sums to 18

Materials

pencil and paper for each child; a marker for each child (optional)

Vocabulary

Vancouver, Saskatoon, Inuvik, Frobisher Bay, St. John's, Quebec

12 ADDITION

Practice



Choose a path and find each sum

1. from Quebec to Frobisher Bay.
2. from Inuvik to Saskatoon.
3. from Vancouver to St. John's.

214 *Answers will vary.*

Play this game.

4. Start at Vancouver. Move $2 + 6$ or 8 spaces. Continue by moving the amount shown in each space on which you land. Try to land exactly at St. John's. (You can go over any space more than once.)

LESSON ACTIVITY

Using the Pages

- Discuss the map of Canada. Have the children trace the outline of Canada. Help the children locate the region where they live and other familiar places on the map. Name the places marked on the map and have the children point to them. Then have a child name two cities marked on the map for the other children to trace a path between the two cities. Lead the children to realize that there are different paths between any two cities.

Read the instructions for Ex. 1-3. Children may wish to use a pencil and paper to find each sum. They may enjoy comparing the sums for different paths for each exercise.

Ask the children how "8 spaces" mentioned in Ex. 4 is obtained. Ensure that the children understand the instructions. Children may wish to use a marker for the game.

A black and white illustration of three children looking at a large, unfolded map. On the left, a girl with dark hair is leaning over the map. In the center, a girl with pigtails and a backpack is looking at the map. On the right, a boy with glasses and a backpack is holding one corner of the map. The map is held open by all three, showing various lines and shapes representing a geographical area.

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OBJECTIVE

Demonstrate competence in addition with no regrouping and with one regrouping, sums to 999; solve related word problems

Materials

models for hundreds, tens, and ones for each child, a container with a label showing a capacity of 125 mL and a container with a label showing a capacity of 625 mL

Vocabulary

millilitre, mL, brim

Note: Since the textbook was printed, Metric Commission Canada has adopted the symbol mL for millilitres. Therefore, the answers are given with the symbol mL.

Practice

Each 7 Up bottle holds 750 ml (millilitres). The smaller cup holds 290 ml. The larger cup holds 475 ml. Will the two cups together hold all the 7 Up from one bottle?

1000 millilitres equal 1 litre.
1000 ml = 1 l

$$\begin{array}{r} \text{Add} \quad 290 \\ + 475 \\ \hline \end{array}$$

Add ones.

$$\begin{array}{r} 290 \\ + 475 \\ \hline 5 \end{array}$$

Add tens and regroup.

$$\begin{array}{r} 290 \\ + 475 \\ \hline 65 \end{array}$$

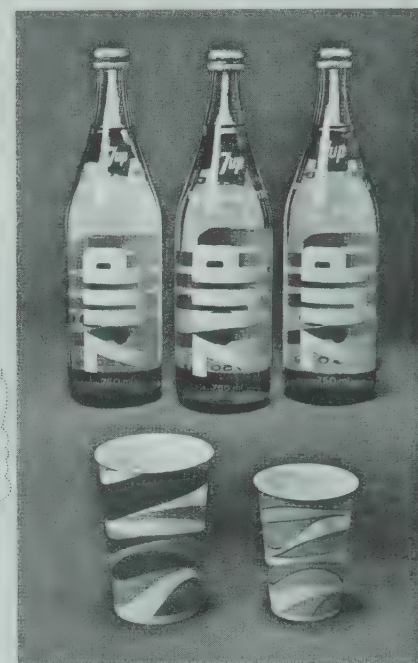
9 tens plus 7 tens equal 16 tens. Regroup 16 tens as 1 hundred, 6 tens.

Add hundreds.

$$\begin{array}{r} 290 \\ + 475 \\ \hline 765 \end{array}$$

In some additions, no regrouping is needed.

$$\begin{array}{r} 213 \\ + 156 \\ \hline 369 \end{array}$$



The cups together hold 765 ml. They will hold the 750 ml of 7 Up from one bottle.

In some additions, 10 ones must be regrouped as 1 ten.

$$\begin{array}{r} 438 \\ + 216 \\ \hline 654 \end{array}$$

8 ones plus 6 ones equal 14 ones. Regroup 14 ones as 1 ten, 4 ones.

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LESSON ACTIVITY

Before Using the Pages

- Display the two containers suggested in *Materials*. Introduce the symbol mL as a measure of capacity. Tell the children that this is the symbol for the word *millilitres*. Ask for the number of millilitres in each container. Then have the children suggest ways to determine the number of millilitres in all. Lead the children to suggest that addition would be used to find the answer.

Distribute the models for hundreds, tens, and ones. Have the children select the models to represent the two addends. Then have the children join the models to represent adding the ones. Record the number of ones as shown. Develop that the ones must be regrouped as 1 ten. Have the children replace the models for 10 ones with a model for 1 ten. Record the zero remaining ones and the new ten as shown. Then have the children join the models to represent adding the tens. Ask for and record the number of tens as shown. Then use a similar procedure for adding the hundreds.

Finally, ask for and record below the chart the number represented by 7 hundreds, 5 tens, and 0 ones.

hundreds	tens	ones
	1	
1	2	5
+ 6	2	5
7	5	10 0
750		

Using the Pages

- Compare the millilitre and the litre. You may wish to point out the symbol mL on containers.

Have the children relate the word problem of the word example to the photograph on page 216. The instructions and the red on the numerals show each step for the word example. Have the children add the ones. Ask why the ones are not regrouped. Develop that regrouping does not occur.



The smaller cups in front hold 205 ml and the larger cups in back hold 265 ml when filled to the brim.

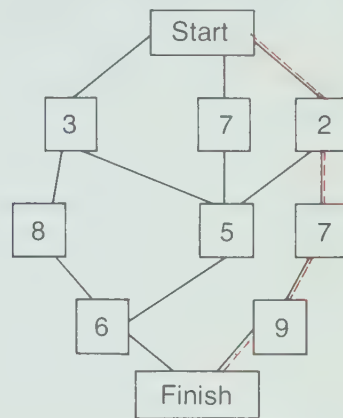
21. How much will the Distance cup and the Speed cup hold in all when filled to the brim? **470 mL**
22. How much will the Mass cup and the Volume cup hold in all when filled to the brim? **410 mL**

The smaller cups hold 170 ml and the larger cups hold 230 ml when filled to the mark near the top.

23. How much will the Temperature cup and the Speed cup hold filled to the mark? **400 mL**
24. How much will the Think Metric cup and the Distance cup hold when filled to the mark? **460 mL**
25. How much will two Mass cups hold when filled to the mark? **340 mL**
- *26. Which holds more, four Volume cups filled to the mark or three Temperature cups filled to the mark?

RELATED ACTIVITIES

- Children having difficulty keeping the columns straight for addition may benefit from completing exercises on a place-value chart or on lined paper turned sideways.
- To provide practice with addition facts, prepare a work sheet with exercises similar to the following. Color the addition path for 18.



The difficulty of the paths can vary according to the ability of the group.

Exercises

Add.

1. $\begin{array}{r} 52 \\ + 24 \\ \hline 76 \end{array}$	2. $\begin{array}{r} 77 \\ + 17 \\ \hline 94 \end{array}$	3. $\begin{array}{r} 59 \\ + 3 \\ \hline 62 \end{array}$	4. $\begin{array}{r} 42 \\ + 66 \\ \hline 108 \end{array}$
5. $\begin{array}{r} 231 \\ + 358 \\ \hline 589 \end{array}$	6. $\begin{array}{r} 128 \\ + 726 \\ \hline 854 \end{array}$	7. $\begin{array}{r} 405 \\ + 67 \\ \hline 472 \end{array}$	8. $\begin{array}{r} 83 \\ + 13 \\ \hline 96 \end{array}$
9. $\begin{array}{r} 498 \\ + 110 \\ \hline 608 \end{array}$	10. $\begin{array}{r} 65 \\ + 8 \\ \hline 73 \end{array}$	11. $\begin{array}{r} 751 \\ + 15 \\ \hline 766 \end{array}$	12. $\begin{array}{r} 66 \\ + 26 \\ \hline 92 \end{array}$
13. $\begin{array}{r} 341 \\ + 442 \\ \hline 783 \end{array}$	14. $\begin{array}{r} 52 \\ + 67 \\ \hline 119 \end{array}$	15. $\begin{array}{r} 270 \\ + 93 \\ \hline 363 \end{array}$	16. $\begin{array}{r} 155 \\ + 34 \\ \hline 189 \end{array}$
17. $\begin{array}{r} 293 \\ + 196 \\ \hline 489 \end{array}$	18. $\begin{array}{r} 347 \\ + 224 \\ \hline 571 \end{array}$	19. $\begin{array}{r} 943 \\ + 37 \\ \hline 980 \end{array}$	20. $\begin{array}{r} 382 \\ + 45 \\ \hline 427 \end{array}$

since there are fewer than 10 ones. Then have the children add the tens and regroup. Review the way of recording the regrouped 1 hundred. Then have the children follow the addition of the hundreds. Read the answer.

Read the statement about regrouping not always being needed. For the second worked example, have the children explain the addition of the ones, the tens, and then the hundreds. Ask the children why regrouping does not occur. Lead the children to state that the sum in each column is less than 10.

Read the statement about regrouping ones as tens. For the third worked example, discuss the addition of the ones. Then review regrouping 14 ones as 1 ten 4 ones. Have children explain the remaining steps of the example.

Exercises: Determine whether any errors in Ex. 1-20 are caused by regrouping when not necessary, by not regrouping when necessary, by incorrect regrouping, or by forgetting addition facts. Provide review and practice, if necessary.

Direct the children's attention to the photograph on page 217. Ask how many millilitres they think the containers

hold. Read the information at the top of page 217 about the capacity of the containers. Have the children explain "filled to the brim" in their own words. Ensure that the children understand that the three cups in front are smaller than the three cups in back. Ask questions such as: "How much will the Temperature cup hold when filled to the brim?"

"Which cup will hold more when filled to the brim, the Volume cup or the Distance cup?"

Then read the information preceding Ex. 23. Ask questions such as:

"How much will the Think Metric cup hold when filled to the mark near the top?"

Have the children answer Ex. 21-26 in a sentence. Ex. 26 is starred because more than one step is required.

OBJECTIVE

Demonstrate competence in addition with no regrouping and with one or two regroupings, sums to 999; solve related word problems

Vocabulary

km, round trip, rentals, banded

Practice

158 airplanes landed at the lake in July.
73 airplanes landed in August. How many airplanes landed in July and August?



$$\begin{array}{r} \text{Add} \quad 158 \\ + \quad 73 \\ \hline \end{array}$$

Add ones
and regroup.

$$\begin{array}{r} \overset{1}{} \\ 158 \\ + 73 \\ \hline 1 \end{array}$$

Add tens
and regroup.

$$\begin{array}{r} \overset{1}{} \overset{1}{} \\ 158 \\ + 73 \\ \hline 31 \end{array}$$

Add hundreds.

$$\begin{array}{r} \overset{1}{} \overset{1}{} \\ 158 \\ + 73 \\ \hline 231 \end{array}$$

231 airplanes landed in July and August.

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LESSON ACTIVITY

Using the Pages

- Use the photograph to motivate a discussion involving the children's experiences with airplanes and what they know about this type of airplane and its uses. Direct the discussion to introduce the word problem at the top of page 218. Discuss the reason for using addition to solve the word problem.

The red on the numerals and the instructions are coordinated for each step of the worked example. Point out that the 11 ones are regrouped as 1 ten and 1 one and that the 1 ten is added with the other tens. Then lead the children to realize that the 13 tens are regrouped as 1 hundred and 3 tens and that the 1 hundred is added in the hundreds' column. Review that regrouping occurs only when the number in a column is greater than nine. Ask why the ones are added first, then the tens, and then the hundreds. Develop that before adding the tens it is necessary to determine whether the ones must be regrouped

and that before adding the hundreds it is necessary to determine whether the tens must be regrouped. Read the concluding statement for the word problem.

Exercises: Have the children answer Ex. 1-4 in a sentence. Ask the children to read Ex. 2 and explain what they think the word *rentals* means. Draw a picture for Ex. 4 on the board and discuss the meaning of *round trip*.

Ex. 4 introduces the symbol km. Have the children compare the symbol km and the word *kilometre* introduced on page 203. Then have them compare the symbol km and the symbols m, dm, and cm. Review that 1000 m equals km.

Remind the children to add the ones, then the tens, and then the hundreds.

Problem Solving: Use the photograph to help explain the meaning of *banded*. Discuss reasons for keeping track of birds and how banding helps.

The word problems require the children to select the necessary information for the solutions.

Exercises

Solve.

1. 275 people stayed at the lodge. 339 camped outdoors. How many people came to the lake in all? **614**

3. A boat is 325 m from one side of the lake and 272 m from the other side. How far is it across the lake? **597m**
2. There were 164 rowboat rentals and 258 canoe rentals. How many rentals were there in all? **422**

4. An airplane flies 258 km (kilometres) to the lake and 258 km back. How far does it fly on a round trip? **516 km**

Add.

5. $\begin{array}{r} 212 \\ + 436 \\ \hline 648 \end{array}$

10. $\begin{array}{r} 28 \\ + 33 \\ \hline 61 \end{array}$

15. $\begin{array}{r} 262 \\ + 480 \\ \hline 742 \end{array}$

20. $\begin{array}{r} 57 \\ + 56 \\ \hline 113 \end{array}$

6. $\begin{array}{r} 52 \\ + 16 \\ \hline 68 \end{array}$

11. $\begin{array}{r} 235 \\ + 17 \\ \hline 252 \end{array}$

16. $\begin{array}{r} 423 \\ + 96 \\ \hline 519 \end{array}$

21. $\begin{array}{r} 168 \\ + 38 \\ \hline 206 \end{array}$

7. $\begin{array}{r} 330 \\ + 57 \\ \hline 387 \end{array}$

12. $\begin{array}{r} 349 \\ + 24 \\ \hline 373 \end{array}$

17. $\begin{array}{r} 75 \\ + 41 \\ \hline 116 \end{array}$

22. $\begin{array}{r} 665 \\ + 195 \\ \hline 860 \end{array}$

8. $\begin{array}{r} 451 \\ + 231 \\ \hline 682 \end{array}$

13. $\begin{array}{r} 454 \\ + 306 \\ \hline 760 \end{array}$

18. $\begin{array}{r} 532 \\ + 176 \\ \hline 708 \end{array}$

23. $\begin{array}{r} 394 \\ + 419 \\ \hline 813 \end{array}$

9. $\begin{array}{r} 154 \\ + 32 \\ \hline 186 \end{array}$

14. $\begin{array}{r} 219 \\ + 669 \\ \hline 888 \end{array}$

19. $\begin{array}{r} 351 \\ + 82 \\ \hline 433 \end{array}$

24. $\begin{array}{r} 217 \\ + 83 \\ \hline 300 \end{array}$

Birds are counted and banded to keep track of how many there are, where they fly, and how fast and far they travel.

On Saturday, 177 geese and 92 ducks were banded.
On Sunday, 119 geese and 186 ducks were banded.

In all, how many

1. geese were banded? **296**
2. ducks were banded? **278**
3. ducks and geese were banded? **574**



PROBLEM SOLVING

RELATED ACTIVITIES

- For reinforcement, have children complete addition exercises with no regrouping and with one regrouping using models or bundles of sticks to represent hundreds, tens, and ones, or using an abacus. Have the children join the ones, regroup if necessary, join the tens, regroup if necessary, and then join the hundreds.
- To provide practice in regrouping, prepare cards similar to the following.

2 hundreds 15 tens 13 ones

Have the children show the number of hundreds, tens, and ones indicated, regroup to prepare for the standard form, and then write the numeral.

- Pairs of cards similar to the following may be prepared for the game “Concentration” on page T349.

3 hundreds 4 tens 11 ones

351

LESSON OUTCOME

Add with regrouping, addends to 999, sums having up to four digits

Materials

models for thousands, hundreds, tens, and ones for each child

Vocabulary

conservation officers, stocked

Prerequisite Skills

Add with one or two regroupings, sums to 999; interpret place value for numerals having four digits

Checking Prerequisite Skills

Add.

$$\begin{array}{r} 1. \quad 258 \\ + \quad 25 \\ \hline 283 \end{array} \quad \begin{array}{r} 2. \quad 347 \\ + \quad 261 \\ \hline 608 \end{array} \quad \begin{array}{r} 3. \quad 408 \\ + \quad 293 \\ \hline 701 \end{array}$$

Complete the following.

$$4. \quad 1503 = \begin{array}{l} \frac{1}{5} \text{ thousand} \\ \frac{5}{0} \text{ hundreds} \\ \frac{0}{3} \text{ tens} \\ \frac{3}{ } \text{ ones} \end{array}$$

$$5. \quad 1 \text{ thousand } 4 \text{ tens } 1 \text{ one} = \underline{1041}$$

Four-Digit Sums

Conservation officers stocked the pond with 850 small fish and 475 large fish. How many fish did they add to the pond?

$$\begin{array}{r} \text{Add} \quad 850 \\ + 475 \\ \hline \end{array}$$

Add ones.

$$\begin{array}{r} 850 \\ + 475 \\ \hline 5 \end{array}$$

Add tens and regroup.

$$\begin{array}{r} 1 \\ 850 \\ + 475 \\ \hline 25 \end{array}$$

Add hundreds.

$$\begin{array}{r} 1 \\ 850 \\ + 475 \\ \hline 1325 \end{array}$$

13 hundreds are 1 thousand, 3 hundreds.

The sum is thirteen hundred twenty-five or one thousand three hundred twenty-five.

The officers added 1325 fish to the pond.

220



LESSON ACTIVITY

Before Using the Pages

- Have the children select models to represent 746. Ask for and record in turn the number of ones, tens, and hundreds on a place-value chart as shown. Repeat this for 489. Tell the children that they are going to add these two numbers. Have the children join the models for the ones. Ask for and record the number of ones. Ask about this many ones in the ones' place. Lead the children to suggest regrouping ones as tens. Have the children replace models for 10 ones with a model for 1 ten. Record the remaining ones and the new ten as shown.

Use a similar procedure for adding the tens.

Then have the children join the models for hundreds. Ask about this many hundreds in the hundreds' place. Develop that 10 hundreds can be regrouped as 1 thousand. Have the children replace models for 10 hundreds with a model for 1 thousand. Record the result as shown.

Finally, ask for and record below the chart the number represented by 1 thousand, 2 hundreds, 3 tens, and 5 ones.

thousands	hundreds	tens	ones
	1	1	
	7	4	6
+	4	8	9
	12	13	15
1	2	3	5

1235

- Use a similar procedure with a few other examples, necessary.

Using the Pages

- Ask the children what is happening in the photographs. During the discussion, introduce the terms *conservation officer* and *stock*. Ask why a conservation officer would stock a pond with fish. Direct the discussion to the word problem at the top of page 220. Establish that addition is used to find the answer.

Working Together

Follow the steps.

1.
$$\begin{array}{r} 714 \\ + 650 \\ \hline \end{array}$$

Add ones.
 Add tens.
 Add hundreds, write the sum as 1364.

2.
$$\begin{array}{r} 995 \\ + 41 \\ \hline 1036 \end{array}$$

Add ones.
 Add tens and regroup.
 Add hundreds and write the sum.

3.
$$\begin{array}{r} 675 \\ + 895 \\ \hline 1570 \end{array}$$

Add and regroup.
 Add and regroup.
 Add and write the sum.



Exercises

Add.

- | | | | | |
|--|--|--|---|--|
| 1. $\begin{array}{r} 824 \\ + 452 \\ \hline 1276 \end{array}$ | 2. $\begin{array}{r} 713 \\ + 551 \\ \hline 1264 \end{array}$ | 3. $\begin{array}{r} 605 \\ + 483 \\ \hline 1088 \end{array}$ | 4. $\begin{array}{r} 913 \\ + 532 \\ \hline 1445 \end{array}$ | 5. $\begin{array}{r} 885 \\ + 704 \\ \hline 1589 \end{array}$ |
| 6. $\begin{array}{r} 831 \\ + 198 \\ \hline 1029 \end{array}$ | 7. $\begin{array}{r} 952 \\ + 64 \\ \hline 1016 \end{array}$ | 8. $\begin{array}{r} 288 \\ + 698 \\ \hline 986 \end{array}$ | 9. $\begin{array}{r} 893 \\ + 43 \\ \hline 936 \end{array}$ | 10. $\begin{array}{r} 846 \\ + 248 \\ \hline 1094 \end{array}$ |
| 11. $\begin{array}{r} 654 \\ + 326 \\ \hline 980 \end{array}$ | 12. $\begin{array}{r} 933 \\ + 985 \\ \hline 1918 \end{array}$ | 13. $\begin{array}{r} 996 \\ + 31 \\ \hline 1027 \end{array}$ | 14. $\begin{array}{r} 646 \\ + 257 \\ \hline 903 \end{array}$ | 15. $\begin{array}{r} 618 \\ + 543 \\ \hline 1161 \end{array}$ |
| 16. $\begin{array}{r} 875 \\ + 627 \\ \hline 1502 \end{array}$ | 17. $\begin{array}{r} 946 \\ + 79 \\ \hline 1025 \end{array}$ | 18. $\begin{array}{r} 637 \\ + 667 \\ \hline 1304 \end{array}$ | 19. $\begin{array}{r} 997 \\ + 8 \\ \hline 1005 \end{array}$ | 20. $\begin{array}{r} 777 \\ + 496 \\ \hline 1273 \end{array}$ |

221

RELATED ACTIVITIES

- Prepare cards similar to the following for children to work in small groups.

$$\begin{array}{r} 753 \\ + 658 \\ \hline \end{array}$$

One child takes a card. Then each child completes the addition using a different one of the following ways: models for thousands, hundreds, tens, and ones; an abacus; bundles of sticks; a place-value chart with cutouts from page T361 as models; and one child completes the exercise on the board. After the children finish each exercise, have them compare their answers. If the answer is written on the back of the card, one child can select one of the ways of completing the exercise and then check by looking at the back of the card.

- Adapt the activity on page T67 for sums having four digits by marking a yellow die to show 1, 4, 5, 6, 7, 8 for hundreds.

- To review addition facts, prepare pairs of cards similar to the following for the game "Snap" described on page T349.

$$7 + 8$$

$$15$$

The red on the numerals and the instructions are coordinated for each step of the worked example. Review the reasons for adding the ones first and for not regrouping the ones. Then review the way of recording the regrouped 1 hundred. Point out how the 13 hundreds are recorded. Read and discuss the information at the bottom of the page. Emphasize that 13 hundreds names the same number as 1 thousand 3 hundreds.

Working Together: Ex. 1 is an example of adding with no regrouping to obtain a four-digit sum. Emphasize the order of the steps and the way of writing the sum. Ex. 2 shows adding with one regrouping and a four-digit sum. For Ex. 3, there are two regroupings when adding to obtain a sum having four digits. Provide other examples of any type for which the children require more practice.

Exercises: Remind the children to follow these steps.

1. Add the ones.
2. Regroup 10 ones as 1 ten if there are more than 9 ones.
3. Add the tens.

4. Regroup 10 tens as 1 hundred if there are more than 9 tens.
5. Add the hundreds.
6. Write the sum for the hundreds' place and the thousands' place.

You may wish to have the children read each answer for Ex. 1-20 in two ways.

Assessment

Add.

- | | | | |
|---|---|---|---|
| 1. $\begin{array}{r} 427 \\ + 601 \\ \hline 1028 \end{array}$ | 2. $\begin{array}{r} 623 \\ + 547 \\ \hline 1170 \end{array}$ | 3. $\begin{array}{r} 581 \\ + 644 \\ \hline 1225 \end{array}$ | 4. $\begin{array}{r} 859 \\ + 752 \\ \hline 1611 \end{array}$ |
|---|---|---|---|

OBJECTIVE

Demonstrate competence in addition with regrouping, adds to 999, sums having up to four digits

Vocabulary

odometer

Practice



Adam kept track of the distances his family drove on their holidays.

1. Was it farther from the city to the lake or from the park to home?
2. Before the trip, Aunt Ida visited Adam's home. How far did she drive over and back? 118 km
3. How far did Adam's family travel from their home to the city? 207 km
4. How far did they travel from the lake to the park? 514 km
5. Was it farther from the city to the mountains or from the mountains to the park?
6. Which is farther from home, the park or the city?

222

LESSON ACTIVITY

Using the Pages

- Discuss the map on page 222. Children may enjoy commenting on the places shown on the map, especially if they have visited similar places recently. Have the children point to the place the holiday begins and ends. Then have them follow the arrows, tracing the route with their fingers and stopping at each place the family visited. At each stop, ask how far the family has traveled since the last stop.

Ask the children how people keep track of the distance traveled in a car. Direct their attention to the odometer on page 223. Discuss the meaning of km/h. Ask questions similar to the following: "If the indicator points to 80, how far will the car travel in 1 h?" Tell the children that this measures the speed and is called the speedometer. Read the information at the top of page 223. Have the children point to the odometer, and then to the ones' place, the tens' place, the hundreds' place, and the thousands' place on the odometer. Tell the children that the black digit on the white

background shows the tenths of a kilometre traveled by car. Tenths are shown in a different color instead of using decimal point. Establish that the car has traveled 119 exactly.

Encourage the children to trace each path with their fingers for Ex. 1-6. For each of Ex. 7-13, have the children draw the six odometer squares to show their answers. Remind them about the digit showing tenths on the odometer. Have them color the square for tenths and ignore it. Point out that the odometer does not show 0 km at beginning of the trip. The odometer shown after Ex. 13 provides a check for the answers. Ex. 13 is starred since children may find the answer by adding the distances traveled during the holiday or they may realize that subtracting 119 from the answer for Ex. 12 is a shorter method. After the children have completed Ex. 13, discuss both of these methods.

Encourage accuracy for Ex. 14-38. Determine whether any difficulty is caused by not knowing the addition facts or not understanding regrouping.

The odometer in their car showed 119 km at the start of the trip.



What will it show when they reach

7. Aunt Ida's? **178 km**
8. the city? **326 km**
9. the lake? **477 km**

Now it should show

0 0 4 7 7 0

What will it show when they reach

10. the mountains? **695 km**
11. the park? **991 km**
12. home? **1122 km**

If the odometer showed

0 0 0 0 0 0

at the start,

- *13. what would it show at the end of the trip? **1003 km**

Add.

- | | | | | |
|--|--|--|--|--|
| 14. $\begin{array}{r} 723 \\ + 644 \\ \hline 1367 \end{array}$ | 15. $\begin{array}{r} 945 \\ + 84 \\ \hline 1029 \end{array}$ | 16. $\begin{array}{r} 103 \\ + 525 \\ \hline 628 \end{array}$ | 17. $\begin{array}{r} 95 \\ + 99 \\ \hline 194 \end{array}$ | 18. $\begin{array}{r} 846 \\ + 93 \\ \hline 939 \end{array}$ |
| 19. $\begin{array}{r} 859 \\ + 616 \\ \hline 1475 \end{array}$ | 20. $\begin{array}{r} 271 \\ + 783 \\ \hline 1054 \end{array}$ | 21. $\begin{array}{r} 447 \\ + 45 \\ \hline 492 \end{array}$ | 22. $\begin{array}{r} 765 \\ + 706 \\ \hline 1471 \end{array}$ | 23. $\begin{array}{r} 323 \\ + 753 \\ \hline 1076 \end{array}$ |
| 24. $\begin{array}{r} 766 \\ + 961 \\ \hline 1727 \end{array}$ | 25. $\begin{array}{r} 877 \\ + 503 \\ \hline 1380 \end{array}$ | 26. $\begin{array}{r} 554 \\ + 277 \\ \hline 831 \end{array}$ | 27. $\begin{array}{r} 480 \\ + 543 \\ \hline 1023 \end{array}$ | 28. $\begin{array}{r} 591 \\ + 558 \\ \hline 1149 \end{array}$ |
| 29. $\begin{array}{r} 926 \\ + 322 \\ \hline 1248 \end{array}$ | 30. $\begin{array}{r} 620 \\ + 586 \\ \hline 1206 \end{array}$ | 31. $\begin{array}{r} 381 \\ + 191 \\ \hline 572 \end{array}$ | 32. $\begin{array}{r} 643 \\ + 812 \\ \hline 1455 \end{array}$ | 33. $\begin{array}{r} 656 \\ + 934 \\ \hline 1590 \end{array}$ |
| 34. $\begin{array}{r} 846 \\ + 727 \\ \hline 1573 \end{array}$ | 35. $\begin{array}{r} 233 \\ + 369 \\ \hline 602 \end{array}$ | 36. $\begin{array}{r} 884 \\ + 328 \\ \hline 1212 \end{array}$ | 37. $\begin{array}{r} 502 \\ + 886 \\ \hline 1388 \end{array}$ | 38. $\begin{array}{r} 879 \\ + 868 \\ \hline 1747 \end{array}$ |

223

RELATED ACTIVITIES

• For practice in addition and preparation for subtraction, provide work sheets with addition exercises having missing digits similar to the following. (The difficulty of the exercises should be adjusted according to the ability of the children.)

no regrouping

$$\begin{array}{r} 253 \\ + 734 \\ \hline 987 \end{array} \quad \begin{array}{r} 344 \\ + 615 \\ \hline 959 \end{array}$$

one regrouping

$$\begin{array}{r} 583 \\ + 207 \\ \hline 790 \end{array} \quad \begin{array}{r} 437 \\ + 682 \\ \hline 1119 \end{array}$$

$$\begin{array}{r} 736 \\ + 635 \\ \hline 1371 \end{array} \quad \begin{array}{r} 870 \\ + 646 \\ \hline 1516 \end{array}$$

two regroupings

$$\begin{array}{r} 553 \\ + 679 \\ \hline 1232 \end{array} \quad \begin{array}{r} 267 \\ + 834 \\ \hline 1101 \end{array}$$

$$\begin{array}{r} 284 \\ + 786 \\ \hline 1070 \end{array} \quad \begin{array}{r} 338 \\ + 896 \\ \hline 1234 \end{array}$$

- Encourage children to watch the odometer in a car. They may enjoy reporting their discoveries.
- Children may draw odometers to illustrate Ex. 7-13 on page 223.
- Children may enjoy creating and solving word problems about the map on page 222 or about their own real or imagined travel experiences.

LESSON OUTCOME

Add amounts of money with regrouping, sums to \$49.99; solve related word problems

Materials

real money, play money, or copies of pages T351 and T352

Prerequisite Skills

Add amounts of money with regrouping, sums to \$9.99; add with regrouping, four-digit sums

Checking Prerequisite Skills

Add.

1.
$$\begin{array}{r} \$2.37 \\ + 3.06 \\ \hline \$5.43 \end{array}$$
 2.
$$\begin{array}{r} \$4.72 \\ + 0.65 \\ \hline \$5.37 \end{array}$$
 3.
$$\begin{array}{r} 628 \\ + 793 \\ \hline 1421 \end{array}$$
 4.
$$\begin{array}{r} 473 \\ + 899 \\ \hline 1372 \end{array}$$

Adding Amounts of Money

A camp stove costs \$27.95. Fuel costs \$1.59. How much do the stove and fuel cost together?

Add $\begin{array}{r} \$27.95 \\ + 1.59 \\ \hline \end{array}$

Add the cents, regroup when needed.

$$\begin{array}{r} \$27.95 \\ + 1.59 \\ \hline 54 \end{array}$$

Add the dollars.

$$\begin{array}{r} \$27.95 \\ + 1.59 \\ \hline \$29.54 \end{array}$$

The stove and fuel cost \$29.54 together.

224

LESSON ACTIVITY

Before Using the Pages

- Display 2 ten-dollar bills, 7 one-dollar bills, 3 dimes, and 5 pennies. Have children record on a chart similar to the following the number of pennies, then the number of dimes, then the number of one-dollar bills, and then the number of ten-dollar bills. Ask a child to state the amount of money. Record this on the chart. Review the position of the dollar sign and of the decimal point. Repeat this procedure with a few examples from \$10.00 to \$49.99.

Ten-dollar bills	One-dollar bills	Dimes	Pennies	Amount

- Write numerals on the chart as shown. Have children select the number of pennies, dimes, one-dollar bills, and ten-dollar bills indicated.

Ten-dollar bills	One-dollar bills	Dimes	Pennies	Amount
1	2	13	16	

Then ask what changes are necessary to prepare writing the amount. Lead the children to suggest regrouping. Have a child replace 10 pennies with 1 dime. Record the regrouping on the chart as shown. Point out that the same amount of money is named.

Ten-dollar bills	One-dollar bills	Dimes	Pennies	Amount
1	2	13 14	16 6	

Then have a child replace 10 dimes with 1 one-dollar bill. Record the regrouping on the chart as shown. Emphasize that this is another way of naming the same amount of money.

Ten-dollar bills	One-dollar bills	Dimes	Pennies	Amount
1	2 3	13 14	16 6	

Working Together

Line up the dollars and cents in vertical form.

1. $\$7.15 + \6.59 2. $\$16.50 + \4.85

Follow the steps.

3.
$$\begin{array}{r} \$19.45 \\ + \$5.81 \\ \hline \$25.26 \end{array}$$

Add _____
Add and regroup _____
Add and regroup _____
Add _____

Exercises

1. $\$14.00$
3. $\$10.66$
5. $\$28.57$

1. $\$7.61 + \6.39 2. $\$5.78 + \2.85 $\$8.63$
3. $\$9.70 + \0.96 4. $\$9.84 + \27.63 $\$37.47$
5. $\$19.29 + \9.28 6. $\$30.43 + \5.87 $\$36.30$

7. $\$7.48 + \5.17 8. $\$6.49 + \0.54 9. $\$4.81 + \9.36
10. $\$25.80 + \7.83 11. $\$16.36 + \6.34 12. $\$32.92 + \7.35
Solve $\$33.63$ $\$22.70$ $\$40.27$

13. $\$34.45$ for a sleeping bag.
 $\$6.25$ for a floor mat.
How much for both? $\$40.70$

14. $\$17.98$ for hiking boots.
 $\$3.50$ for socks.
How much for both? $\$21.48$

*15. $\$16.75$ for a gas lantern.
 $\$3.30$ for a flashlight.
Is $\$20.00$ enough for both? **no**

1. $\$7.15 + \6.59

2. $\$16.50 + \4.85

Copy and complete these multiplication tables.

1. $\times 2$	2. $\times 3$
1 <u>2</u>	1 <u>3</u>
2 <u>4</u>	2 <u>6</u>
3 <u>6</u>	3 <u>9</u>
4 <u>8</u>	4 <u>12</u>
5 <u>10</u>	5 <u>15</u>
6 <u>12</u>	6 <u>18</u>
7 <u>14</u>	7 <u>21</u>
8 <u>16</u>	8 <u>24</u>
9 <u>18</u>	9 <u>27</u>

3. $\times 4$	4. $\times 5$
1 <u>4</u>	1 <u>5</u>
2 <u>8</u>	2 <u>10</u>
3 <u>12</u>	3 <u>15</u>
4 <u>16</u>	4 <u>20</u>
5 <u>20</u>	5 <u>25</u>
6 <u>24</u>	6 <u>30</u>
7 <u>28</u>	7 <u>35</u>
8 <u>32</u>	8 <u>40</u>
9 <u>36</u>	9 <u>45</u>

5. \times	1	2	3	4	5
1	1	2	3	4	5
2	2	4	6	8	10
3	3	6	9	12	15
4	4	8	12	16	20
5	5	10	15	20	25

KEEPING SHARP

225

RELATED ACTIVITIES

• For reinforcement, have children work in pairs to complete addition exercises similar to those on pages 224-225. One child writes the exercise and the other uses coins and bills to find the sum. (Copies of page T351 could be used for the coins, and copies of page T352 could be used for the bills.) After finishing each exercise, have the children compare their answers.

• Provide newspaper advertisements or catalogs for children to select two items and determine the cost. You could arrange a play store and have the children use coins and bills to purchase two items indicated by price tags. (Copies of pages T351 and T352 could be used for the coins and bills.)

• Children may search for patterns in the tables completed for *Keeping Sharp*.

• For more practice with multiplication, children may complete tables similar to those in *Keeping Sharp* with the numbers in a different order. The factors in the left column of the fifth table could be extended to 9.

Then have a child record the amount. Repeat this procedure with other examples from $\$10.00$ to $\$49.99$. Use examples that involve regrouping 10 one-dollar bills as 1-ten dollar bill.

Using the Pages

Use the picture to encourage a discussion about camping. Direct the discussion to introduce the word problem at the top of page 224. Establish that addition is used to find the answer.

The instructions and the red on the numerals show the steps for the worked example. Have the children begin the addition at the right and add the cents. Have them explain the regrouping in their own words. Then have the children add the dollars. Point out the position of the decimal point and of the dollar signs.

Working Together: For Ex. 1 and 2, remind the children to line up the decimal points and point out that the dollar sign is usually written only with the first addend and then also in

the sum as shown on page 224. For Ex. 3, review adding from right to left and regrouping only when necessary.

Exercises: Remind the children to line up the dollars and cents in vertical form for Ex. 1-6. Have them answer Ex. 13-15 in a sentence. Ex. 15 is starred because more than one step is required for the solution.

Keeping Sharp: Ensure that the children understand how to complete the tables. They may remember *Keeping Sharp* on page 169. Encourage the children to review the multiplication facts that they find difficult to remember. You may wish to have them use suggestions for *Related Activities* in Unit 8. Children may enjoy searching for patterns in the fifth table.

Assessment

Add.

1. $\$32.04 + \7.30 $\$39.34$ 2. $\$25.73 + \2.48 $\$28.21$
3. $\$15.76 + \2.18 4. $\$27.99 + \0.01
 $\$17.94$ $\$28.00$

OBJECTIVE

Demonstrate competence in addition with amounts of money, sums to \$49.99

Vocabulary

sales tax table, sub-total, total

Practice

A Sales Tax Table shows how much tax to add on to the price of something.

How much will this fishing rod and reel cost after sales tax is added on?

Between	Tax
\$29.19 and \$29.31	\$2.34
29.32 and 29.43	2.35
29.44 and 29.56	2.36
29.57 and 29.68	2.37
29.69 and 29.81	2.38
29.82 and 29.93	2.39
29.94 and 30.06	2.40
30.07 and 30.18	2.41
30.19 and 30.31	2.42
30.32 and 30.43	2.43

The price of the rod and reel is \$29.90.

\$29.90 is between \$29.82 and \$29.93, so the tax is \$2.39.

Add \$29.90 and \$2.39.

$$\begin{array}{r}
 1 \\
 1 \\
 \$29.90 \\
 + 2.39 \\
 \hline
 \$32.29
 \end{array}$$

The rod and reel cost \$32.29 after sales tax is added on.



LESSON ACTIVITY

Using the Pages

- Ask for the price of the rod and reel shown in the picture. Then ask if this is all you would pay for the rod and reel. Explore the children's concept of sales tax. Develop that the amount of the sales tax increases with the cost of the purchase and that the sales tax is added to the price of the item.
 Direct the children's attention to the sales tax table. Ask:
 "How much sales tax would you pay for something that costs \$29.32?"
 "How much sales tax would you pay for something that costs \$29.43?"
 Point out that the sales tax is the same for both of these prices. Then ask:
 "How much sales tax would you pay for something that costs \$29.33 or \$29.35?"
 Point out that the sales tax is the same for any price from \$29.32 to \$29.43.

Ask for the amount of the sales tax paid for the rod and reel. Then read the worked example. Review that the cents are added first and then the dollars.

Exercises: Tell the children to use the appropriate sales tax table for Ex. 1-3. Ask how to find the sales tax for Ex. 4. Explore possible methods. Children may realize that the sales tax increases by one cent for each price increase of eleven or twelve cents. They may state that since \$11.70 is two cents more than \$11.68, the tax would be between the next two prices listed in the first sales tax table on page 227. For Ex. 5-10, emphasize accuracy, the position of the dollar sign, and the position of the decimal point.

Discuss the meaning of *sub-total* and of *total*. Teach the children to realize how they are related. The instruction telling the children to find the sub-total, the tax, and the total provide guidance for the answers.

Exercises

Find the tax in the table.
Add the tax to the sale price.

1.

2.

3.

4.

Add.

5. \$30.28

6. \$23.99

+ 2.42

+ 1.92

\$32.70

\$25.91

7. \$29.70

8. \$43.66

+ 2.38

+ 3.49

\$32.08

\$47.15

9. \$11.48

10. \$29.39

+ 0.92

+ 2.35

\$12.40

\$31.74

Between	Tax
\$10.94 and \$11.06	\$0.88
11.07 and 11.18	0.89
11.19 and 11.31	0.90
11.32 and 11.43	0.91
11.44 and 11.56	0.92
11.57 and 11.68	0.93

23.82 and 23.93	1.91
23.94 and 24.06	1.92
24.07 and 24.18	1.93
24.19 and 24.31	1.94

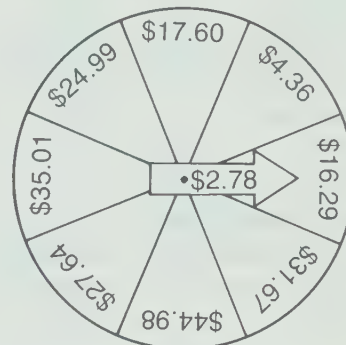
43.19 and 43.31	3.46
43.32 and 43.43	3.47
43.44 and 43.56	3.48
43.57 and 43.68	3.49
43.69 and 43.81	3.50
43.82 and 43.93	3.51

Find the Sub-Total. Find the Tax. Find the Total.

11. Price \$15.55 \$ 8.35 Sub-Total \$23.90 Tax \$1.91 Total \$25.81	12. Price \$37.10 \$ 6.73 Sub-Total \$43.83 Tax \$3.51 Total \$47.34	13. Price \$ 5.67 \$ 5.67 Sub-Total \$11.34 Tax \$0.91 Total \$12.25	14. Price \$10.43 \$ 0.75 Sub-Total \$11.18 Tax \$0.89 Total \$12.07
---	---	---	---

RELATED ACTIVITIES

- A spinner similar to the one shown may be used to provide addition exercises. The number on the arrow and the number on the dial would be the two addends.



- Adapt the second activity on page T 247 and have children purchase one item. Provide a sales tax table for your province (or for another area, if your province does not have a sales tax). Have children determine the sales tax for one selected item and then add the sales tax and the cost of the item.
- Children may enjoy the challenges of completing the sales tax tables shown on pages 226-227.

LESSON OUTCOME

Add three numbers with regrouping, addends to 999, up to four-digit sums

Materials

cards showing the numerals 0 to 9

Vocabulary

legend

Prerequisite Skills

Add two numbers with regrouping, up to four-digit sums; add three one-digit numbers

Checking Prerequisite Skills

Add. 214

1. $473 + 218$ 691 2. $39 + 175$

3. $\begin{array}{r} 678 \\ + 564 \\ \hline 1242 \end{array}$ 4. $\begin{array}{r} 384 \\ + 919 \\ \hline 1303 \end{array}$

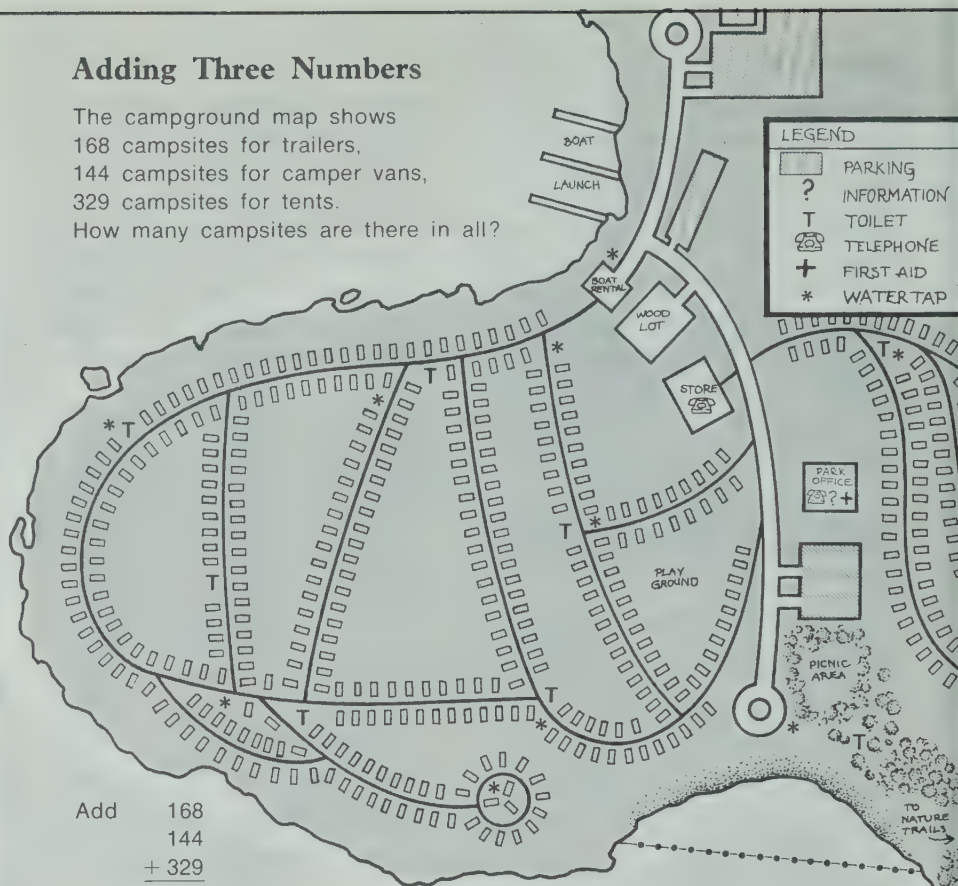
5. $\begin{array}{r} 6 \\ 4 \\ + 8 \\ \hline 18 \end{array}$ 6. $\begin{array}{r} 7 \\ 5 \\ + 1 \\ \hline 13 \end{array}$

Background

See page T 20.

Adding Three Numbers

The campground map shows
168 campsites for trailers,
144 campsites for camper vans,
329 campsites for tents.
How many campsites are there in all?



Add $\begin{array}{r} 168 \\ 144 \\ + 329 \\ \hline \end{array}$

Add ones
and regroup.

$$\begin{array}{r} \text{2} \\ 168 \\ 144 \\ + 329 \\ \hline 1 \end{array}$$

Add tens
and regroup.

$$\begin{array}{r} \text{1 2} \\ 168 \\ 144 \\ + 329 \\ \hline 41 \end{array}$$

Add
hundreds.

$$\begin{array}{r} \text{1 2} \\ 168 \\ 144 \\ + 329 \\ \hline 641 \end{array}$$

There are 641 campsites in all.

228

LESSON ACTIVITY

Before Using the Pages

- As a warm-up, have three children each take a card showing a numeral from 0 to 9. Display the three cards vertically. Have the children add in one direction. Review that two numbers are added first and then the third number is added to the sum. Record the sum. Then have the children add in the other direction. Record the sum again. Compare the two sums. Remind the children that the sum is the same regardless of the order of adding the numbers. Repeat a few times.

Using the Pages

- Encourage the children to discuss their experiences about camping or picnicking. Direct the discussion to the map on page 228. Have the children trace the outline of the land with their fingers. Draw their attention to the legend. Introduce the word *legend*. Have the children point out on the map each place that is listed in the legend.

Use the discussion of the map and of camping to introduce the word problem at the top of page 228. Establish that 168, 144, and 329 are added to find the answer.

The instructions and the red on the numerals are coordinated showing each step of the worked example. Have the children add to find the number of ones first. Ask them about 21 ones in the ones' place. Develop that 20 of the ones are regrouped as 2 tens and added in the tens place. (This is the first time that more than 19 ones are regrouped as tens.) Follow a similar procedure for the tens and the hundreds.

Working Together: Ex. 1-3 provide an opportunity to review lining up hundreds, tens, and ones in vertical form with numerals having a different number of digits. Emphasize the order of the steps for Ex. 4. For Ex. 5, have the children state the steps indicated and reinforce regrouping more than 19 ones and more than 19 tens. Children may benefit from verbalizing the steps as they complete Ex. 6-9. Provide more examples, if necessary.

RELATED ACTIVITIES

• For more practice, children may enjoy finding and correcting the errors in addition exercises similar to the following.

273	168	436
487	272	829
+ 364	+ 652	+ 130
1114	992	1295
1124	1092	1395
278	372	528
143	651	607
+ 301	+ 278	+ 523
1722	1300	168
722	1301	1658
706	37	380
8	258	431
+ 537	+ 673	+ 267
1261	1968	1068
1251	968	1078

• Children may wish to create word problems based on the map on page 228.

• To review adding three numbers less than 10, use the activity in *Related Activities* on page T57.

Working Together

Line up the hundreds, tens, and ones in vertical form.

1. $524 + 36 + 208$

$$\begin{array}{r} 1. \ 524 \\ \ 36 \\ + 208 \\ \hline \end{array}$$

$$\begin{array}{r} 2. \ 32 \\ \ 421 \\ + 379 \\ \hline \end{array}$$

$$\begin{array}{r} 3. \ 245 \\ \ 9 \\ + 84 \\ \hline \end{array}$$

2. $32 + 421 + 379$

3. $245 + 9 + 84$

Follow the steps.

4.
$$\begin{array}{r} 11 \\ 282 \\ \ 133 \\ + \ 57 \\ \hline 472 \end{array}$$

Add ones and regroup.

Add tens and regroup.

Add hundreds.

$$\begin{array}{r} 282 \\ \ 133 \\ + \ 57 \\ \hline \end{array}$$



5.
$$\begin{array}{r} 22 \\ 386 \\ \ 47 \\ + 168 \\ \hline 601 \end{array}$$

..... first step

..... second step

..... third step

$$\begin{array}{r} 386 \\ \ 47 \\ + 168 \\ \hline \end{array}$$



Add.

6.
$$\begin{array}{r} 271 \\ 183 \\ + 322 \\ \hline 776 \end{array}$$

7.
$$\begin{array}{r} 426 \\ 89 \\ + 175 \\ \hline 690 \end{array}$$

8.
$$\begin{array}{r} 168 \\ 7 \\ + 32 \\ \hline 207 \end{array}$$

9.
$$\begin{array}{r} 325 \\ 303 \\ + 467 \\ \hline 1095 \end{array}$$

Exercises

Show the addends in vertical form and add.

1. $126 + 153 + 208$ 487 2. $57 + 84 + 239$ 380 3. $26 + 9 + 108$ 143

4. $315 + 591 + 139$ 1045 5. $365 + 677 + 49$ 1091 6. $217 + 235 + 276$ 728

7. $248 + 88 + 74$ 410 8. $126 + 440 + 528$ 1094 9. $582 + 113 + 252$ 947

Add.

10.
$$\begin{array}{r} 209 \\ 477 \\ + 262 \\ \hline 948 \end{array}$$

11.
$$\begin{array}{r} 513 \\ 262 \\ + 127 \\ \hline 902 \end{array}$$

12.
$$\begin{array}{r} 23 \\ 164 \\ + 76 \\ \hline 263 \end{array}$$

13.
$$\begin{array}{r} 338 \\ 323 \\ + 433 \\ \hline 1094 \end{array}$$

14.
$$\begin{array}{r} 112 \\ 7 \\ + 86 \\ \hline 205 \end{array}$$

15.
$$\begin{array}{r} 206 \\ 356 \\ + 54 \\ \hline 54 \end{array}$$

16.
$$\begin{array}{r} 402 \\ 1249 \\ + 284 \\ \hline 284 \end{array}$$

17.
$$\begin{array}{r} 648 \\ 813 \\ + 115 \\ \hline 115 \end{array}$$

18.
$$\begin{array}{r} 150 \\ 503 \\ + 106 \\ \hline 106 \end{array}$$

19.
$$\begin{array}{r} 223 \\ 917 \\ + 368 \\ \hline 368 \end{array}$$

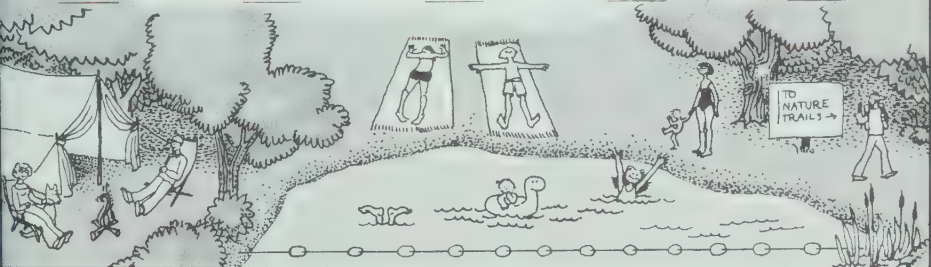
20.
$$\begin{array}{r} 206 \\ 356 \\ + 54 \\ \hline 54 \end{array}$$

21.
$$\begin{array}{r} 402 \\ 1249 \\ + 284 \\ \hline 284 \end{array}$$

22.
$$\begin{array}{r} 648 \\ 813 \\ + 115 \\ \hline 115 \end{array}$$

23.
$$\begin{array}{r} 150 \\ 503 \\ + 106 \\ \hline 106 \end{array}$$

24.
$$\begin{array}{r} 223 \\ 917 \\ + 368 \\ \hline 368 \end{array}$$



Exercises: For Ex. 1-9, emphasize lining up the hundreds, tens, and ones in vertical form. Remind the children to add the ones, then the tens, and then the hundreds.

Assessment

1. $2 + 79 + 6$ 517 2. $82 + 273 + 99$ 454

3.
$$\begin{array}{r} 380 \\ 246 \\ 78 \\ \hline 704 \end{array}$$

4.
$$\begin{array}{r} 102 \\ 839 \\ + 276 \\ \hline 1217 \end{array}$$

OBJECTIVE

Demonstrate competence in addition of three addends with regrouping, sums having up to four digits, with and without amounts of money

Materials

a straight edge, a copy of one shape from page T 363, and pieces of tracing paper for each child

Practice

Add.

$$\begin{array}{r} 1. \quad 321 \\ \quad 63 \\ + \quad 56 \\ \hline 440 \end{array}$$

$$\begin{array}{r} 4. \quad 272 \\ \quad 549 \\ + \quad 87 \\ \hline 908 \end{array}$$

$$\begin{array}{r} 7. \quad 293 \\ \quad 105 \\ + \quad 259 \\ \hline 657 \end{array}$$

$$\begin{array}{r} 10. \quad 229 \\ \quad 364 \\ + \quad 116 \\ \hline 709 \end{array}$$

$$\begin{array}{r} 13. \quad 325 \\ \quad 269 \\ + \quad 249 \\ \hline 843 \end{array}$$

$$\begin{array}{r} 16. \quad \$2.87 \\ \quad 1.86 \\ + \quad 0.97 \\ \hline \$5.70 \end{array}$$

$$\begin{array}{r} 19. \quad \$2.43 \\ \quad 3.87 \\ + \quad 8.63 \\ \hline \$14.93 \end{array}$$

$$\begin{array}{r} 2. \quad 99 \\ \quad 436 \\ + \quad 75 \\ \hline 610 \end{array}$$

$$\begin{array}{r} 5. \quad 486 \\ \quad 22 \\ + \quad 67 \\ \hline 575 \end{array}$$

$$\begin{array}{r} 8. \quad 308 \\ \quad 48 \\ + \quad 545 \\ \hline 901 \end{array}$$

$$\begin{array}{r} 11. \quad 592 \\ \quad 114 \\ + \quad 478 \\ \hline 1184 \end{array}$$

$$\begin{array}{r} 14. \quad 595 \\ \quad 35 \\ + \quad 375 \\ \hline 1005 \end{array}$$

$$\begin{array}{r} 17. \quad \$3.45 \\ \quad 0.23 \\ + \quad 2.61 \\ \hline \$6.29 \end{array}$$

$$\begin{array}{r} 20. \quad \$4.57 \\ \quad 2.53 \\ + \quad 3.93 \\ \hline \$11.03 \end{array}$$

$$\begin{array}{r} 3. \quad 67 \\ \quad 93 \\ + \quad 87 \\ \hline 247 \end{array}$$

$$\begin{array}{r} 6. \quad 84 \\ \quad 76 \\ + \quad 312 \\ \hline 472 \end{array}$$

$$\begin{array}{r} 9. \quad 161 \\ \quad 181 \\ + \quad 138 \\ \hline 480 \end{array}$$

$$\begin{array}{r} 12. \quad 116 \\ \quad 432 \\ + \quad 77 \\ \hline 625 \end{array}$$

$$\begin{array}{r} 15. \quad 538 \\ \quad 457 \\ + \quad 295 \\ \hline 1290 \end{array}$$

$$\begin{array}{r} 18. \quad \$1.24 \\ \quad 0.46 \\ + \quad 0.38 \\ \hline \$2.08 \end{array}$$

$$\begin{array}{r} 21. \quad \$3.17 \\ \quad 0.68 \\ + \quad 2.96 \\ \hline \$6.81 \end{array}$$

What would the calculator show for each sum?

$$22. \quad 88888888$$

$$+ \quad 88888888$$

$$+ \quad 88888888$$

$$= \quad 705$$

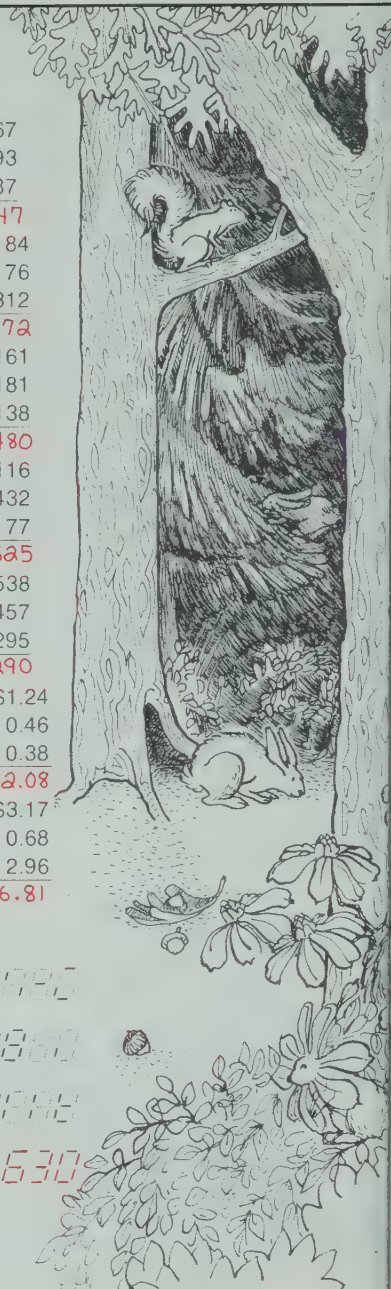
$$23. \quad 88888888$$

$$+ \quad 88888888$$

$$+ \quad 88888888$$

$$= \quad 630$$

230



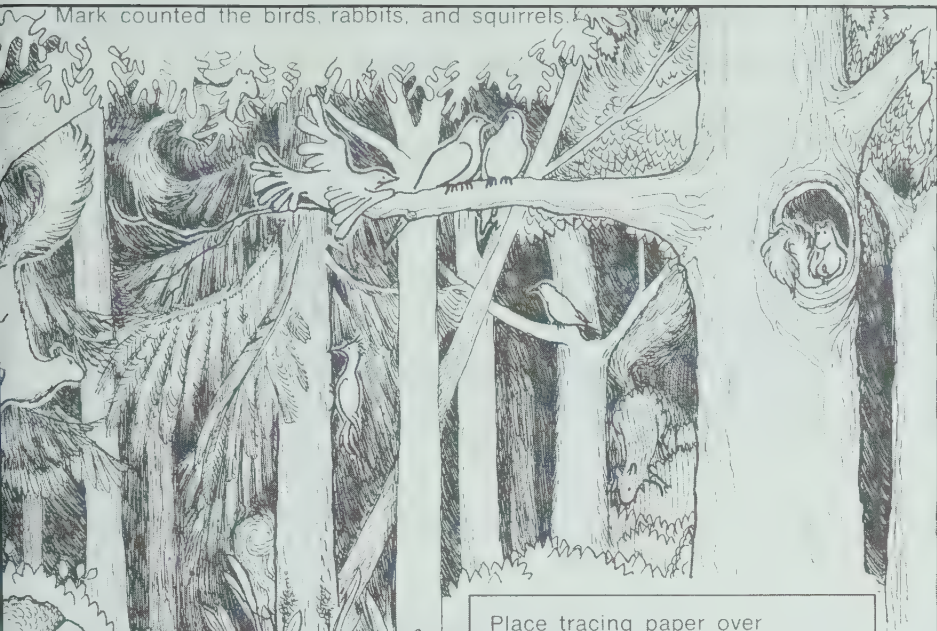
LESSON ACTIVITY

Using the Pages

- Ask the children about regrouping. Lead them to suggest that regrouping occurs when the number in any column is greater than nine, but at no other time. Remind the children to include the dollar signs and the decimal points for Ex. 16-21. You may wish to review how calculator digits are written for Ex. 22 and 23. Encourage accuracy. Determine the cause of any difficulty and reteach if necessary.

Direct the children's attention to the graph Mark made. Establish that the numerals on the side of the graph show the number of each kind of animal and that the names show the kinds of animals counted. Ask, in turn, for the number of birds, rabbits, and squirrels recorded on the graph. Then discuss the animals in the forest scene. Have the children point to an animal that can be seen easily. Then challenge them to locate an animal that Mark may have missed. Read Ex. 24. Children can use a copy of one shape on page T 363 to make the graph.

Try This: Have the children place their straight edges on picture. Then have them turn their straight edges so that animals are separated into two groups. Read the instructions and discuss that two more fences must be shown to separate the animals from each other. Provide the children with sheets of tracing paper on which they will make fences by trial and error.



Place tracing paper over this picture. Draw three straight fences to separate the animals from each other.



**try
this**

231

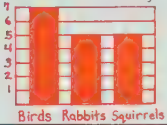
RELATED ACTIVITIES

- For addition practice and preparation for subtraction, provide a work sheet with addition exercises having missing addends similar to the following.

$\begin{array}{r} 436 \\ 27 \\ + \quad \boxed{1}\boxed{2} \\ \hline 475 \end{array}$	$\begin{array}{r} 268 \\ \boxed{1}\boxed{6} \\ + 567 \\ \hline 851 \end{array}$
$\begin{array}{r} 428 \\ \boxed{4}\boxed{0}\boxed{6} \\ + 736 \\ \hline 1570 \end{array}$	$\begin{array}{r} 284 \\ 693 \\ + \quad \boxed{2}\boxed{8}\boxed{4} \\ \hline 1261 \end{array}$
$\begin{array}{r} \boxed{5}\boxed{4}\boxed{5} \\ 267 \\ + 438 \\ \hline 1250 \end{array}$	$\begin{array}{r} 752 \\ 600 \\ + \quad \boxed{9}\boxed{9} \\ \hline 1451 \end{array}$
$\begin{array}{r} 643 \\ \boxed{4}\boxed{7}\boxed{0} \\ + 309 \\ \hline 1422 \end{array}$	$\begin{array}{r} 673 \\ \boxed{6}\boxed{0}\boxed{5} \\ + 250 \\ \hline 1528 \end{array}$

- Have children make bar graphs about topics of interest to them, for example, their favorite animals or colors. These could be displayed.
- Children may enjoy recording some of the exercises on page 230 as calculator digits.

224. He made a graph to show how many he saw. But he did not see the hidden animals. Make a graph to show all the animals you can find.



OBJECTIVE

Select the necessary information for solving a problem, and then solve the problem

Materials

a large paper with the word story in *Before Using the Page*

Background

Problems with too much information are also presented on page 66. However, on page 66, the children are asked to select the information that *is not needed* for solving the problems. On page 232, the children are instructed to choose the information that *is needed* for solving the problems and also to solve the problems.

RELATED ACTIVITIES

- Encourage the children to find and report situations in everyday life when they select the necessary information to solve a problem.
- Children may wish to create and solve word problems with unnecessary information for others to solve. The pictures in Unit 12 may provide a topic for the problems.
- Children may rewrite word problems from other pages in their mathematics textbook and include unnecessary information.

Choosing the Information Needed

To solve problems, you have to choose the information you need.

Example:

One morning the Gibbs family drove 75 km. Then they stopped for gas. They bought 40 l of gas for \$9.60. They also spent 85¢ for snacks. Then they drove 188 km more to Uncle Art's. The whole trip took 3 h (hours) and 20 min (minutes). How far did they drive?

Here is the only information needed to solve the problem:

Home to gas station: 75 km
Gas station to Uncle Art's: 188 km
Add $75 + 188 = 263$
The Gibbs family drove 263 km.

Choose the information needed for solving each problem. Then solve the problem.

1. There are 15 m of red ribbon and 23 m of red string. There are also 8 m of blue ribbon. The ribbon is on 2 spools. How many metres of ribbon are there in all? **23**
2. One bottle of ketchup holds 350 ml. Another bottle holds 275 ml. A third bottle holds 625 ml. 825 ml are needed for the picnic. How much ketchup do the two larger bottles hold? **975 mL**
3. At one store Rhoda bought a shirt for \$2.95 and a billfold for \$2.49. She spent 80¢ for a milk shake. Then she bought some socks for \$1.95. How much did Rhoda spend for clothes? **\$4.90**
4. The zoo had 375 birds in its collection. 227 of them were songbirds. It received a shipment of 38 birds. 29 of them were songbirds. Now how many songbirds are in the collection? **256**

PROBLEM SOLVING

232

LESSON ACTIVITY

Before Using the Page

- Read the following story.
“Mark went camping with his parents, his two sisters, and his brother. They traveled 200 km from their home and stayed for six days. On the first day, Mark saw six squirrels, three birds, two rabbits, and a snake. One of his sisters counted five squirrels on the first day. During the next five days, Mark saw four squirrels, and his sisters and brother saw seven. On the last day, they did not see any animals. How many squirrels did Mark see?”

Probably the children will not know the number of squirrels. Discuss the reason that they cannot answer the question easily. Develop that they were not aware of the question while they were listening to the story.

Display the paper with the story on the board. Have children circle the information necessary for solving the problem. Establish that the other information does not influence the answer. Then have them solve the problem.

Using the Page

- Read the word problem in the worked example. Discuss more information than necessary is given. Then read thought cloud showing the only information needed solve the problem, and also the solution.
- Read the instructions. Encourage the children to read entire problem carefully a few times to relate the ques to the necessary given information.

OBJECTIVE

Demonstrate an understanding of the concepts and skills presented in this unit

RELATED ACTIVITIES

• For more addition practice, have children find the hidden “bingo” as described on page T53. Use the following chart and exercises.

961	1408	669	1619
1126	1211	1103	1091
1328	1149	1409	1002
1428	1195	1212	683

402 + 267 669	828 + 133 961	340 + 786 1126
428 + 767 1195	258 + 953 1211	784 + 625 1409
734 285 + 72 1091	682 5 + 932 1619	248 72 + 829 1149
267 + 735 1002	368 + 844 1212	604 + 724 1328

• You may wish to provide magazines for children to search for pictures that suggest addition situations to them. Then have the children form small groups and have each child explain how her/his picture suggests addition. (The important aspect is that the child finds something in the picture that suggests addition to her/him.)

• You may wish to arrange an art lesson in which the children draw or paint pictures that suggest addition. Children could tell others how the pictures show addition.

Checking Up

Add.

- $$\begin{array}{r} 36 \\ + 62 \\ \hline 98 \end{array}$$
- $$\begin{array}{r} 217 \\ + 92 \\ \hline 309 \end{array}$$
- $$\begin{array}{r} 135 \\ + 129 \\ \hline 264 \end{array}$$
- $$\begin{array}{r} 278 \\ + 157 \\ \hline 435 \end{array}$$
- $$\begin{array}{r} 435 \\ + 712 \\ \hline 1147 \end{array}$$
- $$\begin{array}{r} 456 \\ + 580 \\ \hline 1036 \end{array}$$
- $$\begin{array}{r} 609 \\ + 617 \\ \hline 1226 \end{array}$$
- $$\begin{array}{r} 863 \\ + 254 \\ \hline 1117 \end{array}$$
- $$\begin{array}{r} 974 \\ + 72 \\ \hline 1046 \end{array}$$
- $$\begin{array}{r} 580 \\ + 420 \\ \hline 1000 \end{array}$$
- $$\begin{array}{r} 329 \\ + 845 \\ \hline 1174 \end{array}$$
- $$\begin{array}{r} 587 \\ + 503 \\ \hline 1090 \end{array}$$
- $$\begin{array}{r} \$4.02 \\ + 4.35 \\ \hline \$8.37 \end{array}$$
- $$\begin{array}{r} \$5.07 \\ + 5.21 \\ \hline \$10.28 \end{array}$$
- $$\begin{array}{r} \$5.19 \\ + 6.34 \\ \hline \$11.53 \end{array}$$
- $$\begin{array}{r} \$5.81 \\ + 7.34 \\ \hline \$13.15 \end{array}$$
- $$\begin{array}{r} 483 \\ 53 \\ + 6 \\ \hline 542 \end{array}$$
- $$\begin{array}{r} 145 \\ 29 \\ + 239 \\ \hline 413 \end{array}$$
- $$\begin{array}{r} 576 \\ 250 \\ + 381 \\ \hline 1207 \end{array}$$
- $$\begin{array}{r} 173 \\ 783 \\ + 423 \\ \hline 1379 \end{array}$$

Solve.

- A bait bucket costs \$1.59. A flashlight costs \$8.90. How much do both cost? **\$10.49**
- Pierre rode 16 km from home to school and 178 km from school to the lake. A boat took him 8 km across the lake to camp. How far did Pierre go from home to camp? **202 km**
- A paper cup holds 180 ml of hot chocolate. A mug holds 420 ml. How many millilitres of hot chocolate are needed to fill the cup and the mug? **600**
- A canteen costs \$3.69. How much do two of the canteens cost? **\$7.38**
- 538 children went to camp in the first month. 645 children went to camp in the second month. How many children went to camp in the two months? **1183**
- 87 pancakes were made from one package of mix. 85 were made from another package and 88 were made from a third package. How many pancakes were made in all? **260**

233

Skills	Exercises	Related Pages
1-digit, two-digit sums	1	T 242-T 243 T 246-T 247 T 250-T 251
1-digit, three-digit sums	2-4	
1-digit, four-digit sums	5-12	
1-digit, amounts of money	13-16	
1-digit, three addends	17-20	
1-digit, word addition problems	21-26	

Comments

Determine whether errors in regrouping are caused by regrouping when not necessary, by not regrouping when necessary, or by regrouping incorrectly. Children having difficulty with regrouping may benefit from showing addition exercises and the necessary regrouping with models for ones, tens, hundreds, and ones.

By watching the children complete the exercises, you will be able to determine whether they work from right to left in considering the place values. Review the reasons for this order.

Unit 13 Overview

Subtraction

This unit serves to review and consolidate the subtraction concepts of the third year of the elementary mathematics program. In Unit 5, the emphasis was on exploring and understanding the underlying concepts of subtraction with regrouping. In this unit the emphasis should be on mastering the standard algorithm with accuracy and reasonable efficiency.

The new work in this unit is a natural extension of the objectives of Unit 5. Subtraction is now extended to include four-digit minuends, some of which have up to three zeros. Subtraction is applied to a variety of problem situations including amounts of money up to \$19.99. The inverse relationship between addition and subtraction is investigated and used to establish a procedure for checking subtraction.

Prerequisite Skills

- complete basic subtraction facts, minuends to 18
- subtract numbers with two regroupings, minuends to 999
- subtract amounts of money with regrouping, minuends to \$9.99
- interpret place value in numerals to 9999

Unit Outcomes

- subtract with regrouping, minuends having up to four digits, subtrahends and differences to 999
- subtract amounts of money with regrouping, minuends to \$19.99; solve related word problems
- use addition to check subtraction
- subtract with regrouping zero tens and/or zero hundreds in the minuend
- find the missing information for a problem

Background

This unit is a sequel to Unit 5 in which the children were introduced to regrouping in subtraction. Initially, tens were regrouped as ones, then hundreds were regrouped as tens, and finally, the children were expected to regroup both tens and hundreds in the same exercise. The regrouping was shown by crossing out the particular digits of the minuend and writing each new number of units above, for example,

$$\begin{array}{r} 11 \\ 4 \cancel{1} 4 \\ \cancel{8} \cancel{2} \cancel{4} \\ - 267 \\ \hline 257 \end{array}$$

In Unit 12, children encountered four-digit sums in the addition of three-digit addends, for example,

$$\begin{array}{r} 11 \\ 465 \\ + 789 \\ \hline 1254 \end{array}$$

The sum was interpreted in two ways, as “twelve hundred fifty-four” and as “one thousand two hundred fifty-four”. Thus, from their work of renaming four-digit numbers in Unit 11, children can interpret such numbers with and without the use of the term *thousand*. This knowledge is helpful in work with subtraction. In this unit a four-digit number is seen only as a

minuend. The subtrahend and the difference have no more than three digits. The same principles that were used previously with subtraction can be extended to exercises with four-digit minuends. In an example similar to the following, children interpret the minuend, 1463, as “fourteen hundred sixty-three” and then subtract 8 hundreds from 14 hundreds to obtain hundreds.

$$\begin{array}{r} \boxed{14} 63 \\ - 821 \\ \hline 642 \end{array}$$

Exercises with regrouping can be dealt with in a similar way. For the following example, “one thousand four hundred” is thought of as “14 hundreds”.

$$\begin{array}{r} 16 \\ \boxed{4} \cancel{1} 3 \\ \boxed{1} \cancel{8} \cancel{7} \cancel{4} \\ - 894 \\ \hline 679 \end{array}$$

Note that at this time, the number in the thousands' place is always *one*. Such exercises help to prepare children for future work in subtraction when they will regroup four-digit numbers. That process will involve regrouping one of the thousands as hundreds. Subtraction of the hundreds will then be similar to subtraction with four-digit minuends in this unit.

$$\begin{array}{r} 7 \boxed{14} \\ \cancel{8} \cancel{4} 63 \\ - 3821 \\ \hline 4642 \end{array}$$

In Unit 5, special attention was given to exercises for which the minuend showed 0 tens, because children frequently had difficulty regrouping in such situations. To facilitate subtraction, it was suggested that the minuend, 506, for example, be thought of as 50 tens 6 ones and then regrouped as 49 tens 16 ones (A). A similar lesson in this unit deals with zero in four-digit minuends, and the approach described above is applied. For 1000 - 426 (B), one thousand is interpreted as 99 tens 10 ones and is regrouped as 99 tens 10 ones. The subtraction then proceeds place by place from right to left.

<p>A</p> $\begin{array}{r} 4916 \\ \cancel{5} \cancel{0} \cancel{6} \\ - 287 \\ \hline 219 \end{array}$	<p>B</p> $\begin{array}{r} 9910 \\ \cancel{1} \cancel{0} \cancel{0} \cancel{0} \\ - 426 \\ \hline 574 \end{array}$
---	--

Addition and subtraction are inverse operations. They are sometimes described as “doing” and “undoing” operations because what one “does”, the other “undoes”. This relationship was used in Unit 1 to establish families of facts to assist in the mastery of basic addition and subtraction facts.

The inverse relationship between addition and subtraction is most useful in that addition can be performed to check that the difference in a subtraction is correct. This concept was first met in earlier work with subtraction. It is reviewed formally. Children are led to realize that a subtraction is correct if the sum of the difference (D) and the subtrahend (S) is the same as the minuend (M).

<p>M</p> $\begin{array}{r} 611 \\ 14 \cancel{7} \cancel{8} \\ - 623 \\ \hline 848 \end{array}$	<p>S</p> $\begin{array}{r} 1 \\ 848 \\ + 623 \\ \hline 1471 \end{array}$
<p>D</p> 848	

aching Strategies

This unit provides an opportunity to review or reteach the subtraction concepts. Before beginning the unit, you may wish to administer the diagnostic test included at the end of this review, to determine whether children have mastered the objectives of the previous subtraction units. These objectives include basic subtraction facts (minuends to 18), subtraction with no regrouping and with one or two regroupings (minuends to 99), and subtraction with 0 tens in the minuend. According to their results, the children may be grouped for the appropriate teaching and review. The first three lessons of this unit are devoted to practice exercises. These review subtraction concepts presented earlier. Some children will need only a short review of work before the exercises are assigned. For other children, it may be necessary to reteach using suitable activities and manipulative materials. If time did not permit the use of certain materials and activities suggested in Unit 5, these may be used to offer a fresh approach to the concept of subtraction with regrouping.

Expanded notation can be applied to reteach subtraction with regrouping and can offer a different approach that may help the children to understand the concept. An example is shown below.

Step 1 Express the numbers in expanded form.

$$\begin{array}{r} 700 + 30 + 5 \\ 200 + 60 + 8 \end{array}$$

Step 2 Regroup 1 ten as 10 more ones and subtract the ones.

$$\begin{array}{r} 700 + \boxed{20} + \boxed{15} \\ 200 + 60 + 8 \\ \hline 7 \end{array}$$

Step 3 Regroup 1 hundred as 10 more tens and subtract the tens.

$$\begin{array}{r} \boxed{600} + \boxed{120} + 15 \\ 200 + 60 + 8 \\ \hline 60 \quad 7 \end{array}$$

Step 4 Subtract the hundreds and write the difference in standard form.

$$\begin{array}{r} 7 \quad 3 \quad 5 \\ 2 \quad 6 \quad 8 \\ \hline 4 \quad 6 \quad 7 \end{array} \quad \begin{array}{r} 600 + 120 + 15 \\ 200 + 60 + 8 \\ \hline 400 + 60 + 7 \end{array}$$

Many children will be familiar with operations and their inverses, such as lacing and unlacing a shoe, or unbuttoning and buttoning a coat. It should be pointed out that after the sequence of two inverse operations, the original situation exists. For example, when an open door is shut ("doing") and then opened ("undoing"), it is in its original state (open). Mathematically, if 4 is subtracted from 12 and then 4 is added to the difference, the result is the original number, 12.

$$\begin{array}{r} 12 \\ - 4 \\ \hline 8 \end{array} \quad \begin{array}{r} 8 \\ + 4 \\ \hline 12 \end{array}$$

This relationship is best reviewed first with basic addition and subtraction facts. Then the concept can be applied to checking subtraction with three-digit and four-digit minuends by using the same relationship.

Materials

models for thousands, hundreds, tens, and ones for each child (optional)
copies of the division table on page T367 for use with *Keeping Sharp* on page 239 (optional)
real money, play money, or copies of pages T351 and T352
two boxes such as cereal boxes for which the mass is marked in grams

Vocabulary

Roman numerals Chinese numerals Braille
gram (g)

Diagnostic Test

Part A examines basic subtraction facts for minuends to 18. For Part B the arrangement of the exercises examines the subtraction algorithm for minuends to 999 as follows.

- Row 1 — no regrouping
- Row 2 — regrouping tens as ones
- Row 3 — regrouping hundreds as tens
- Row 4 — two regroupings
- Row 5 — regrouping with 0 tens in the minuend
- Column 1 — two-digit subtrahends
- Column 2 — three-digit subtrahends
- Column 3 — amounts of money, minuends to \$9.99

Part A

1. $\begin{array}{r} 11 \\ - 3 \\ \hline \end{array}$	2. $\begin{array}{r} 15 \\ - 6 \\ \hline \end{array}$	3. $\begin{array}{r} 12 \\ - 4 \\ \hline \end{array}$	4. $\begin{array}{r} 10 \\ - 2 \\ \hline \end{array}$	5. $\begin{array}{r} 16 \\ - 7 \\ \hline \end{array}$
---	---	---	---	---

Part B

6. $\begin{array}{r} 97 \\ - 61 \\ \hline \end{array}$	7. $\begin{array}{r} 769 \\ - 534 \\ \hline \end{array}$	8. $\begin{array}{r} \$4.80 \\ - 1.10 \\ \hline \end{array}$
9. $\begin{array}{r} 84 \\ - 57 \\ \hline \end{array}$	10. $\begin{array}{r} 790 \\ - 164 \\ \hline \end{array}$	11. $\begin{array}{r} \$6.73 \\ - 2.14 \\ \hline \end{array}$
12. $\begin{array}{r} 223 \\ - 71 \\ \hline \end{array}$	13. $\begin{array}{r} 612 \\ - 262 \\ \hline \end{array}$	14. $\begin{array}{r} \$9.25 \\ - 7.30 \\ \hline \end{array}$
15. $\begin{array}{r} 553 \\ - 96 \\ \hline \end{array}$	16. $\begin{array}{r} 914 \\ - 258 \\ \hline \end{array}$	17. $\begin{array}{r} \$6.62 \\ - 1.84 \\ \hline \end{array}$
18. $\begin{array}{r} 607 \\ - 33 \\ \hline \end{array}$	19. $\begin{array}{r} 908 \\ - 329 \\ \hline \end{array}$	20. $\begin{array}{r} \$7.00 \\ - 4.38 \\ \hline \end{array}$

OBJECTIVE

Demonstrate competence in completing basic subtraction facts, minuends to 18

Vocabulary

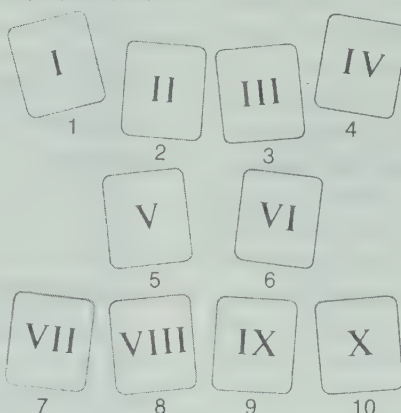
Roman numerals, Chinese numerals, Braille

13 SUBTRACTION

Practice

There are different ways to show numbers.

Roman numerals:



Subtract. Draw a Roman numeral to show each difference.

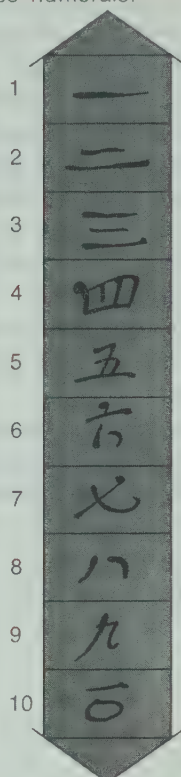
Refer to the Roman Numerals.

- | | | |
|---|--|---|
| 1. $\begin{array}{r} 6 \\ -4 \\ \hline 2 \end{array}$ | 2. $\begin{array}{r} 12 \\ -9 \\ \hline 3 \end{array}$ | 3. $\begin{array}{r} 10 \\ -1 \\ \hline 9 \end{array}$ |
| 4. $\begin{array}{r} 10 \\ -3 \\ \hline 7 \end{array}$ | 5. $\begin{array}{r} 13 \\ -9 \\ \hline 4 \end{array}$ | 6. $\begin{array}{r} 11 \\ -3 \\ \hline 8 \end{array}$ |
| 7. $\begin{array}{r} 6 \\ -5 \\ \hline 1 \end{array}$ | 8. $\begin{array}{r} 6 \\ -1 \\ \hline 5 \end{array}$ | 9. $\begin{array}{r} 15 \\ -9 \\ \hline 6 \end{array}$ |
| 10. $\begin{array}{r} 16 \\ -8 \\ \hline 8 \end{array}$ | 11. $\begin{array}{r} 15 \\ -5 \\ \hline 10 \end{array}$ | 12. $\begin{array}{r} 9 \\ -4 \\ \hline 5 \end{array}$ |
| 13. $\begin{array}{r} 6 \\ -2 \\ \hline 4 \end{array}$ | 14. $\begin{array}{r} 13 \\ -7 \\ \hline 6 \end{array}$ | 15. $\begin{array}{r} 11 \\ -8 \\ \hline 3 \end{array}$ |

Subtract. Draw a Chinese numeral to show each difference.

Refer to the Chinese numerals.

- | | | | | | | | | | | | |
|---|---|---|---|---|--|--|---|--|---|---|--|
| 16. $\begin{array}{r} 11 \\ -2 \\ \hline 9 \end{array}$ | 17. $\begin{array}{r} 8 \\ -1 \\ \hline 7 \end{array}$ | 18. $\begin{array}{r} 13 \\ -8 \\ \hline 5 \end{array}$ | 19. $\begin{array}{r} 13 \\ -5 \\ \hline 8 \end{array}$ | 20. $\begin{array}{r} 10 \\ -7 \\ \hline 3 \end{array}$ | 21. $\begin{array}{r} 10 \\ -0 \\ \hline 10 \end{array}$ | 22. $\begin{array}{r} 5 \\ -4 \\ \hline 1 \end{array}$ | 23. $\begin{array}{r} 18 \\ -9 \\ \hline 9 \end{array}$ | 24. $\begin{array}{r} 7 \\ -4 \\ \hline 3 \end{array}$ | 25. $\begin{array}{r} 15 \\ -8 \\ \hline 7 \end{array}$ | 26. $\begin{array}{r} 11 \\ -7 \\ \hline 4 \end{array}$ | 27. $\begin{array}{r} 7 \\ -2 \\ \hline 5 \end{array}$ |
| 28. $\begin{array}{r} 9 \\ -3 \\ \hline 6 \end{array}$ | 29. $\begin{array}{r} 12 \\ -4 \\ \hline 8 \end{array}$ | 30. $\begin{array}{r} 10 \\ -8 \\ \hline 2 \end{array}$ | | | | | | | | | |



Have a friend check your work.

234

LESSON ACTIVITY

Using the Pages

- Ask the children if they have seen or heard of the different ways of showing numbers that appear on pages 234-235. They have probably noticed Roman numerals on clocks or in books. Discuss each of these ways of writing numerals. The children may enjoy discussing the different numerals on pages 234-235. Roman numerals were used for hundreds of years in Europe. Chinese numerals were painted with a brush. Braille consists of raised dots that can be felt by the fingers. There are hand signs for letters and words as well as for numerals. Ask the children when Braille and hand signs are necessary.

Emphasize accuracy for the exercises. Have the children write the difference as usual and then show the answer in the way specified for the exercises. (For the hand signs you may wish to have the children demonstrate the signs.) This enables you to determine whether an error is due to a mistake in subtraction or in the use of the other numeral.

Braille:



1



2



3



4



5



6



7



8

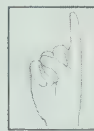


9

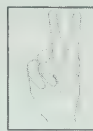


10

Hand signs:



1



2



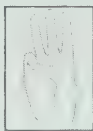
3



4



5



6



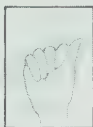
7



8



9



10

Subtract. Draw a Braille numeral to show each difference.

Refer to the Braille numerals.

31. $\begin{array}{r} 11 \\ - 6 \\ \hline 5 \end{array}$	32. $\begin{array}{r} 4 \\ - 1 \\ \hline 3 \end{array}$	33. $\begin{array}{r} 14 \\ - 6 \\ \hline 8 \end{array}$
34. $\begin{array}{r} 8 \\ - 4 \\ \hline 4 \end{array}$	35. $\begin{array}{r} 17 \\ - 8 \\ \hline 9 \end{array}$	36. $\begin{array}{r} 8 \\ - 6 \\ \hline 2 \end{array}$
37. $\begin{array}{r} 12 \\ - 7 \\ \hline 5 \end{array}$	38. $\begin{array}{r} 8 \\ - 2 \\ \hline 6 \end{array}$	39. $\begin{array}{r} 14 \\ - 7 \\ \hline 7 \end{array}$
40. $\begin{array}{r} 9 \\ - 8 \\ \hline 1 \end{array}$	41. $\begin{array}{r} 15 \\ - 7 \\ \hline 8 \end{array}$	42. $\begin{array}{r} 11 \\ - 5 \\ \hline 6 \end{array}$
43. $\begin{array}{r} 13 \\ - 3 \\ \hline 10 \end{array}$	44. $\begin{array}{r} 4 \\ - 2 \\ \hline 2 \end{array}$	45. $\begin{array}{r} 9 \\ - 5 \\ \hline 4 \end{array}$

Have a friend check your work.

Subtract. Show each difference with a hand sign. Refer to the hand signs.

46. $\begin{array}{r} 10 \\ - 6 \\ \hline 4 \end{array}$	47. $\begin{array}{r} 16 \\ - 9 \\ \hline 7 \end{array}$	48. $\begin{array}{r} 5 \\ - 3 \\ \hline 2 \end{array}$
49. $\begin{array}{r} 14 \\ - 8 \\ \hline 6 \end{array}$	50. $\begin{array}{r} 10 \\ - 2 \\ \hline 8 \end{array}$	51. $\begin{array}{r} 15 \\ - 6 \\ \hline 9 \end{array}$
52. $\begin{array}{r} 10 \\ - 5 \\ \hline 5 \end{array}$	53. $\begin{array}{r} 6 \\ - 3 \\ \hline 3 \end{array}$	54. $\begin{array}{r} 10 \\ - 9 \\ \hline 1 \end{array}$
55. $\begin{array}{r} 17 \\ - 9 \\ \hline 8 \end{array}$	56. $\begin{array}{r} 12 \\ - 6 \\ \hline 6 \end{array}$	57. $\begin{array}{r} 18 \\ - 8 \\ \hline 10 \end{array}$
58. $\begin{array}{r} 8 \\ - 5 \\ \hline 3 \end{array}$	59. $\begin{array}{r} 12 \\ - 3 \\ \hline 9 \end{array}$	60. $\begin{array}{r} 11 \\ - 4 \\ \hline 7 \end{array}$

RELATED ACTIVITIES

- To reinforce subtraction facts, prepare a number line from 0 to 100 to be used as a game board, a die marked 4, 5, 6, 7, 8, 9, a die marked 11, 12, 13, 14, 15, 16, and a marker for each player. Each player in turn throws the dice, subtracts the lesser number from the greater number, and (if the difference is correct) moves the number of places indicated by the difference. The first player to reach 100 is the winner. The game may be played by one to four players.

- Adapt the fourth or fifth activity on page T237 for subtraction.

- Have children list the places where they can find Roman numerals.

- Children may enjoy research to extend the numeration systems shown on pages 234-235 beyond 10 or to find other ways of showing numerals, for example, the Greek or the Egyptian numerals. They may create a display showing subtraction facts with various numerals.

- A leader can ask a small group of children to state the difference for a subtraction fact. The other children (with their books open at page 235 for reference) can answer by showing the difference with a hand sign. This activity could be used as a game. Each player who immediately shows the correct answer scores one point. After fifteen turns, the player with the most points becomes the next leader.

OBJECTIVE

Demonstrate competence in subtraction with no regrouping and with one regrouping, minuends to 999; solve related word problems

Materials

models for hundreds, tens, and ones for each child

Practice

A storm put 925 telephones out of service. In one hour, the line workers had 780 fixed. How many were still out of service?

$$\begin{array}{r} \text{Subtract } 925 \\ - 780 \\ \hline \end{array}$$

Subtract ones.

$$\begin{array}{r} 925 \\ - 780 \\ \hline 5 \end{array}$$

Cannot subtract 8 tens from 2 tens.

Regroup

9 hundreds, 2 tens as

8 hundreds, 12 tens.

$$\begin{array}{r} \overset{8}{\cancel{9}}\overset{12}{\cancel{2}}5 \\ - 780 \\ \hline 5 \end{array}$$

Then subtract tens and subtract hundreds.

$$\begin{array}{r} \overset{8}{\cancel{9}}\overset{12}{\cancel{2}}5 \\ - 780 \\ \hline 145 \end{array}$$

145 telephones were still out of service.

In some subtractions no regrouping is needed.

$$\begin{array}{r} 574 \\ - 264 \\ \hline 310 \end{array}$$



In some subtractions 1 ten must be regrouped as 10 ones.

$$\begin{array}{r} \overset{8}{\cancel{4}}\overset{13}{\cancel{3}}8 \\ - 368 \\ \hline 125 \end{array}$$

Cannot subtract 8 ones from 3 ones. Regroup 9 tens, 3 ones as 8 tens, 13 ones.

236

LESSON ACTIVITY

Before Using the Pages

- Write 651 on a place-value chart. Have the children select models to represent this number. Then write 142 on the place-value chart and indicate the operation as subtraction. Review that one of the 5 tens must be regrouped as 10 ones to allow for subtracting the ones. Have the children use their models to replace 1 ten with 10 ones. Record the regrouping on the place-value chart as shown. Emphasize that the same number is named after the regrouping. Have the children remove the models to represent subtracting the ones. Record the difference in the ones' place.

Have the children remove the models to represent subtracting the tens. Record the difference in the tens' place. Use a similar procedure for the hundreds.

Finally, record the standard numeral for 5 hundreds 0 tens 9 ones.

hundreds	tens	ones
	4	11
6	5	1
- 1	4	2
5	0	9

509

Using the Pages

- If appropriate, use the photograph on page 236 to motivate discussion about experiences the children have had with telephones that are out of service and with telephon repairs. Remind them about the danger of touching broke wires. Direct the discussion of the word problem in the worked example.

The instructions and the red on the numerals are coordinated to show each step of the worked example. For subtracting the ones, read the instructions and discuss the numerals. Ask why there is no regrouping before subtracting

Exercises

Subtract.

1. 41
- 23
18

2. 409
- 26
383

3. 797
- 122
675

4. 477
- 9
468

5. 63
- 43
20

6. 507
- 277
230

7. 139
- 45
94

8. 535
- 106
429

9. 729
- 350
379

10. 81
- 48
33

11. 730
- 15
715

12. 927
- 165
762

13. 350
- 170
180

14. 609
- 599
10
- Solve.
15. 185 children were tested on dialing a telephone. 37 dialed wrong numbers. How many dialed correctly? **148**

16. Out of 226 children, 192 knew a number to call in case of emergency. How many did not know an emergency number? **34**

*17. Suzie found her telephone number on page 48 of the telephone book. Faye found hers on page 53. How many pages are between 48 and 53? **4**
- A telephone dial shows both letters and numerals.
-
- If your home phone number is 697-5223 you can call home by dialing MYPLACE. What is the telephone number.
- | | If to call | You had to dial |
|----|------------------|-----------------|
| 1. | the Library | LIBRARY |
| 2. | the fruit market | BANANAS |
1. **542-7279** 2. **226-2627**
What words can you make for these telephone numbers?
3. **LAUNDRY** 4. **TOY LAND**
- | | To call | You must dial |
|----|---------------|---------------|
| 3. | the laundry | 528-6379 |
| 4. | the toy store | 869-5263 |
| 5. | the zoo | 264-6257 |
5. **ANIMALS**

6. Can there be a word for your telephone number?
-
- 237
- RELATED ACTIVITIES
- Children having difficulty keeping the columns straight in subtraction exercises may benefit from completing exercises on a place-value chart or on lined paper turned sideways.
 - You may wish to have children create and solve word problems similar to Ex. 17 on page 237. They could use a book to check their answers.
- You may wish to have the children discover how to use subtraction for finding the number of pages between two given pages in a book. For example, the number of pages between 48 and 53 is one less than the result of subtracting 48 from 53; that is, $(53 - 48) - 1 = 4$. Have the children use a book to check their answers.
- Children may enjoy writing their own telephone numbers as a sequence of letters.
 - Children may use the telephone dial as a guide and translate sentences from books or sentences of their own into numbers.
- ing the ones. Establish that regrouping does not occur since the ones can be subtracted without regrouping. Then discuss what is involved in subtracting the tens. Read the information about regrouping. Emphasize that 8 hundreds 12 tens 5 ones names the same number as 9 hundreds 2 tens 5 ones. Have the children explain the regrouping in their own words. Then have the children follow the subtraction of the tens and the hundreds. Point out that the word problem is answered in a sentence.
- ead that regrouping is not always necessary in subtraction. For the second worked example, have the children discuss the subtraction of the ones, the tens, and then the hundreds. Ask why regrouping does not occur.
- ead the statement about regrouping 1 ten as 10 ones. For the third worked example, develop that the ones cannot be subtracted without regrouping. Emphasize that 4 hundreds 8 tens 13 ones names the same number as 4 hundreds 9 tens 3 ones. Have the children explain the steps for the remainder of the example.
- Exercises:** Emphasize subtracting the ones, then the tens, and then the hundreds. Determine whether any errors in Ex. 1-14 are caused by regrouping when not necessary, by not regrouping when necessary, by incorrect regrouping, or by forgetting subtraction facts. Provide review and practice, if necessary. Ex. 17 is starred because the answer is not found by subtraction, but by thinking of (drawing or looking at) the pages in a book. Discuss the fact that pages 48 and 53 are not included in the pages that are between 48 and 53.
- Try This:** Ask a child to give her/his telephone number. Have another child refer to the illustration on page 237 to express the telephone number with letters. Then read the example. Point out that dialing a telephone number by numerals is the same as dialing the telephone number by letters. Children may enjoy sharing their answers for Ex. 6.
- T261

OBJECTIVE

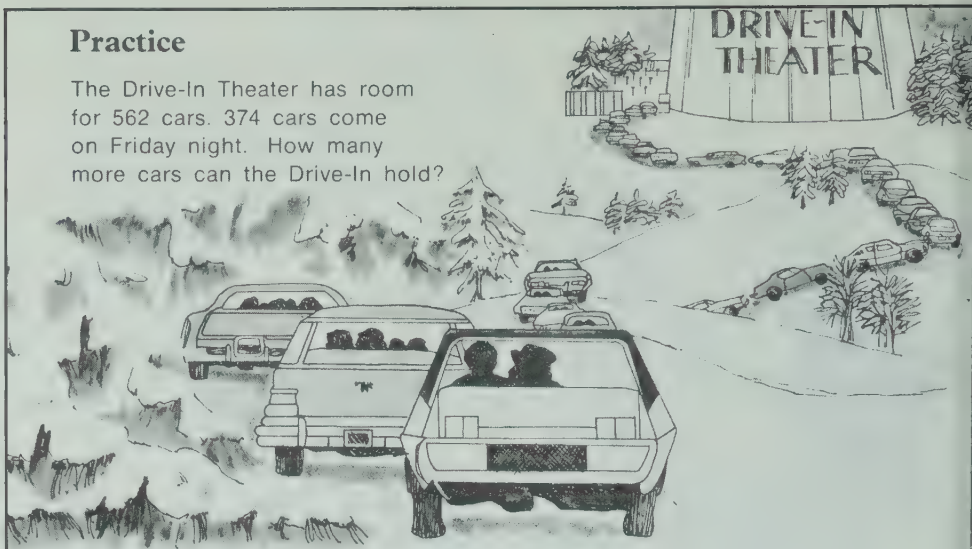
Demonstrate competence in subtraction with no regrouping and with one or two regroupings, minuends to 999; solve related word problems

Materials

copies of the division table on page T367 (optional for *Keeping Sharp*)

Practice

The Drive-In Theater has room for 562 cars. 374 cars come on Friday night. How many more cars can the Drive-In hold?



To find how many more, subtract

$$\begin{array}{r} 562 \\ - 374 \\ \hline \end{array}$$

Cannot subtract 4 ones from 2 ones. Regroup 6 tens, 2 ones as 5 tens, 12 ones.

$$\begin{array}{r} 5\overset{5}{\cancel{6}}2 \\ - 374 \\ \hline \end{array}$$

Subtract ones.

$$\begin{array}{r} 5\overset{5}{\cancel{6}}2 \\ - 374 \\ \hline 8 \end{array}$$

Cannot subtract 7 tens from 5 tens. Regroup 5 hundreds, 5 tens as 4 hundreds, 15 tens.

$$\begin{array}{r} 15\overset{4}{\cancel{5}}\overset{12}{\cancel{6}}2 \\ - 374 \\ \hline 8 \end{array}$$

Subtract tens.

$$\begin{array}{r} 15\overset{4}{\cancel{5}}\overset{12}{\cancel{6}}2 \\ - 374 \\ \hline 88 \end{array}$$

Subtract hundreds.

$$\begin{array}{r} 15\overset{4}{\cancel{5}}\overset{12}{\cancel{6}}2 \\ - 374 \\ \hline 188 \end{array}$$

The Drive-In Theater can hold 188 more cars.

238

LESSON ACTIVITY

Using the Pages

- Children may enjoy talking about watching a movie. Lead the discussion to the word problem for the worked example. Ask the children to find the words in the problem that suggest subtraction is needed to solve the problem. Then establish that the ones cannot be subtracted without regrouping. Discuss the need for regrouping one of the 6 tens as 10 ones. Point out that 5 hundreds 5 tens 12 ones names the same number as 5 hundreds 6 tens 2 ones. Have the children follow the subtracting of the ones. Then lead them to realize that the tens cannot be subtracted without regrouping. Discuss the need for regrouping one of the 5 hundreds as 10 tens. Emphasize that 4 hundreds 15 tens 12 ones, 5 hundreds 5 tens 12 ones, and 5 hundreds 6 tens 2 ones are different ways of naming the same number. Have the children follow the subtracting of the tens and then the subtracting of the hundreds. Point out that the answer to the word problem is written in a sentence.

Ask the children why the ones are subtracted first, then the tens, and then the hundreds. Establish that it is necessary to determine whether 1 ten must be regrouped as 10 ones before subtracting the ones and whether 1 hundred must be regrouped as 10 tens before subtracting the tens.

Exercises: It is important that errors be diagnosed to determine whether they are due to a lack of understanding of regrouping or from a lack of recall of the subtraction facts. In Ex. 12, point out the symbol min for minutes. Ex. 14 is starred because the children have to decide what information is needed for solving the problem. You may wish to refer to page 232.

Keeping Sharp: Copies of the division table on page T367 may be used for Ex. 1-4. Remind the children to use drawing subtraction, or number lines to find any answers they do not remember. If they have forgotten many of the division facts, you may wish to use activities from Unit 9 for review. Review how to complete Ex. 5. It is similar to Ex. 2-4 on page 207. Finding the numbers to complete the row and the left column provides practice in division.

Exercises

Subtract.

1. 831
- 487
344

2. 140
- 93
47

3. 564
- 86
478

4. 906
- 156
750

5. 413
- 248
165

6. 472
- 55
417

7. 881
- 329
552

8. 536
- 491
45

9. 306
- 63
243

10. 896
- 649
247

Solve.

11. 374 cars at the theater. 289 were on time for the first movie. How many missed the start?**85**
12. The first movie lasts 145 min (minutes). The second movie lasts 93 min. How much longer is the first movie?**52 min**
13. After the first movie, 314 people visit the snack bar. 178 visit it after the second movie. How many more visited it after the first movie?**136**
- *14. 374 cars at the theater. 28 leave after the first movie. 107 leave before the third movie. How many are there for the second movie?**346**

Copy and complete these division tables.

1. ÷ 2
2
4 **2**
6 **3**
8 **4**
10 **5**
12 **6**
14 **7**
16 **8**
18 **9**

2. ÷ 3
27
24 **8**
21 **7**
18 **6**
15 **5**
12 **4**
9 **3**
6 **2**
3 **1**
3. ÷ 4
4 **1**
12 **3**
20 **5**
28 **7**
36 **9**
8 **2**
16 **4**
24 **6**
32 **8**

4. ÷ 5
45 **9**
5 **1**
40 **8**
10 **2**
35 **7**
15 **3**
30 **6**
20 **4**
25 **5**

Copy and complete this multiplication table.

5.

×	4	3	1	2
4	16	12	4	8
0	0	0	0	0
5	20	15	5	10
3	12	9	3	6

Think

$4 \times \dots = 12$
 $4 \times 3 = 12$

and write 3 as one of the factors.

KEEPING SHARP

RELATED ACTIVITIES

- Children having difficulty with subtraction may benefit from using models for hundreds, tens, and ones, an abacus, or copies of the cutouts on page T361 to complete subtraction exercises. Have the children assemble the models to represent the first number in the subtraction exercise. Then have them remove the models to represent subtracting the ones, then the tens, and then the hundreds, regrouping whenever necessary.
- To reinforce division facts, have children search for number patterns in the first four completed tables in *Keeping Sharp*.
- For more practice with multiplication and division, prepare work sheets with tables such as the following. (The difficulty can be varied according to the ability of the children.)

×	3	4
2	6	8
3	9	12

×	4	5	8	6
4	16	20	32	24
3	12	15	24	18
1	4	5	8	6
2	8	10	16	12

×	4	3	2	5
0	0	0	0	0
3	12	9	6	15
2	8	6	4	10
6	24	18	12	30

LESSON OUTCOME

Subtract with regrouping, minuends having up to four digits, subtrahends and differences to 999

Materials

models for thousands, hundreds, tens, and ones for each child (optional)

Prerequisite Skills

Subtract with one or two regroupings, minuends to 999; interpret place value for numerals having four digits

Checking Prerequisite Skills

Subtract.

$$\begin{array}{r} 1. \quad 426 \\ - 186 \\ \hline 240 \end{array} \quad \begin{array}{r} 2. \quad 370 \\ - 27 \\ \hline 343 \end{array} \quad \begin{array}{r} 3. \quad 975 \\ - 488 \\ \hline 487 \end{array}$$

Complete the following.

4. $1205 = \underline{1}$ thousand
 $\quad \quad \underline{2}$ hundreds
 $\quad \quad \underline{0}$ tens
 $\quad \quad \underline{5}$ ones

5. 1 thousand 6 hundreds
 $= \underline{1600}$

Subtracting from Four-Digit Numbers

Max keeps a list of radio stations he hears. His list had 625 stations after one year and 1348 after the next year. How many new stations did he hear in the second year?

$$\begin{array}{r} \text{Subtract} \quad 1348 \\ - \quad 625 \\ \hline \end{array}$$

$$\begin{array}{r} 1348 \\ - 625 \\ \hline 23 \end{array}$$

Subtract ones.
Subtract tens.

$$\begin{array}{r} 1348 \\ - 625 \\ \hline 23 \end{array}$$

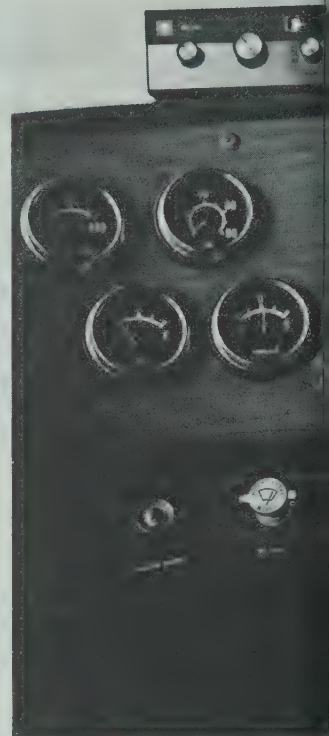
Cannot subtract 6 hundreds from 3 hundreds.
Think of 1 thousand, 3 hundreds as 13 hundreds.

$$\begin{array}{r} 1348 \\ - 625 \\ \hline 723 \end{array}$$

Subtract hundreds.

Max heard 723 new stations in the second year.

240



LESSON ACTIVITY

Before Using the Pages

- Write the numeral 1456 on a place-value chart. Ask the children to find a way to represent this number using only 4 tens. Lead them to suggest that 5 tens can be regrouped as 4 tens and 10 ones. Record the regrouping on the chart as shown.

thousands	hundreds	tens	ones
		4	16
1	4	5	6

Ask the children to find a way to represent the number using only 3 hundreds. Lead them to suggest regrouping one of the 4 hundreds as 10 tens. Record the regrouping on the chart as shown. Point out that this is another way of naming the same number.

thousands	hundreds	tens	ones
		14	
1	4	5	6

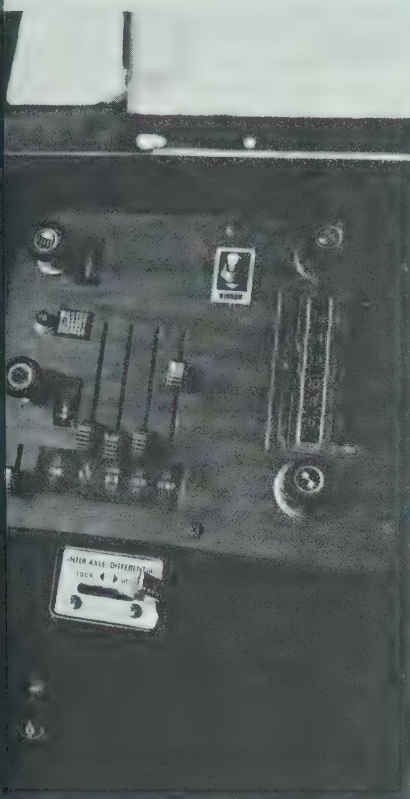
Ask the children to find a way to represent the number without thousands. Establish that the 1 thousand can be regrouped as 10 hundreds. Record the regrouping on the chart as shown. Emphasize that this is another way of naming the same number.

thousands	hundreds	tens	ones
	13	14	
1	4	5	6

If children have difficulty understanding the regrouping, have them show each step using models for thousands, hundreds, tens, and ones.

Using the Pages

- Use the photograph to motivate a discussion about listening to the radio and about using a CB radio. Then read the word problem for the worked example. Ask what operation should be used to solve the problem. Have the children follow the subtracting of the ones and then the tens. Direct



Exercises

Subtract.

- | | |
|--|--|
| 1. $\begin{array}{r} 1269 \\ - 843 \\ \hline \end{array}$ | 2. $\begin{array}{r} 1575 \\ - 724 \\ \hline \end{array}$ |
| 3. $\begin{array}{r} 1072 \\ - 735 \\ \hline \end{array}$ | 4. $\begin{array}{r} 1123 \\ - 690 \\ \hline \end{array}$ |
| 5. $\begin{array}{r} 629 \\ - 345 \\ \hline \end{array}$ | 6. $\begin{array}{r} 1487 \\ - 573 \\ \hline \end{array}$ |
| 7. $\begin{array}{r} 114 \\ - 72 \\ \hline \end{array}$ | 8. $\begin{array}{r} 1512 \\ - 562 \\ \hline \end{array}$ |
| 9. $\begin{array}{r} 1480 \\ - 741 \\ \hline \end{array}$ | 10. $\begin{array}{r} 125 \\ - 61 \\ \hline \end{array}$ |
| 11. $\begin{array}{r} 1465 \\ - 929 \\ \hline \end{array}$ | 12. $\begin{array}{r} 375 \\ - 187 \\ \hline \end{array}$ |
| 13. $\begin{array}{r} 1164 \\ - 999 \\ \hline \end{array}$ | 14. $\begin{array}{r} 1059 \\ - 382 \\ \hline \end{array}$ |
| 15. $\begin{array}{r} 1358 \\ - 563 \\ \hline \end{array}$ | 16. $\begin{array}{r} 1650 \\ - 651 \\ \hline \end{array}$ |

Solve.

17. On the CB radio, a driver told Max about driving 720 km of a 1296 km trip. How much farther did the other driver have to go? **576 km**
18. Max was heading for Calgary. One road sign showed

Calgary 1200 km

Max drove 650 km more that day. How far did he still have to go? **550 km**

241

Working Together

Think of 1 thousand, 3 hundreds as 13 hundreds. Then complete each subtraction.

1. $\begin{array}{r} 1384 \\ - 932 \\ \hline \end{array}$	2. $\begin{array}{r} 1458 \\ - 572 \\ \hline \end{array}$
452	886

Subtract.

3. $\begin{array}{r} 1693 \\ - 846 \\ \hline \end{array}$	4. $\begin{array}{r} 1335 \\ - 350 \\ \hline \end{array}$
847	985

RELATED ACTIVITIES

- For reinforcement, adapt the first activity on page T 243 for subtraction. Prepare cards similar to the following.

$$\begin{array}{r} 1236 \\ - 857 \\ \hline \end{array}$$

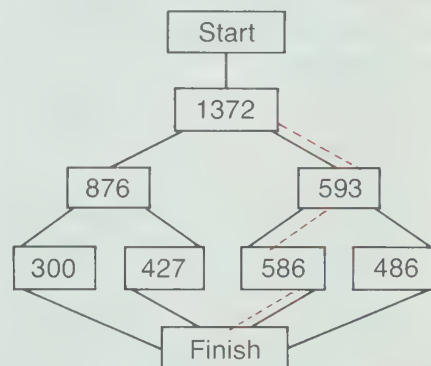
Have each child use models to represent the first number in the subtraction exercise (1236) and then remove the models representing the second number (857). Remind the children to regroup the models whenever necessary.

- For practice with subtraction facts, pairs of cards similar to the following may be used for the game "Concentration" described on page T 349.

$$15 - 7$$

$$8$$

- You may wish to prepare work sheets with exercises similar to the following. Color the subtraction path for 193.



their attention to subtracting the hundreds. Establish that the hundreds cannot be subtracted without regrouping. Tell the children that 1 thousand can be regrouped as 10 hundreds so that 1 thousand 3 hundreds is thought of as 13 hundreds. Since the 1 thousand 3 hundreds can be easily read as 13 hundreds in the exercise, it is not necessary to write the regrouping. Then have the children discuss subtracting the hundreds. Read the concluding statement.

Remind the children that four-digit numerals representing years may be read without using thousands as given in Ex. 19-25 on page 207.

Working Together: Since Ex. 1 and 2 are partially completed, the children can direct their attention to subtracting the hundreds. Have the children follow the steps that are shown and then subtract the hundreds. For Ex. 1 and 2, point out that 1 thousand 3 hundreds is thought of as 13 hundreds. When the children have completed Ex. 3 and 4, have several children explain the steps in their own words. Emphasize that 1 thousand 6 hundreds is thought of as 16 hundreds for Ex. 3 and that 1 thousand 2 hundreds is

thought of as 12 hundreds for Ex. 4. Provide similar examples, if necessary.

Exercises: Remind the children to regroup only when necessary and to subtract the ones, then the tens, and then the hundreds. For Ex. 1-16, encourage accuracy and speed. After the exercises are completed, you may wish to have children identify in which exercises 1 thousand is thought of as 10 hundreds.

Ex. 17 and 18 provide an opportunity to review the symbol km.

Assessment

Subtract.

- | | |
|---|---|
| 1. $\begin{array}{r} 1738 \\ - 825 \\ \hline \end{array}$ | 2. $\begin{array}{r} 1567 \\ - 872 \\ \hline \end{array}$ |
| 913 | 695 |
| 3. $\begin{array}{r} 1423 \\ - 608 \\ \hline \end{array}$ | 4. $\begin{array}{r} 1230 \\ - 857 \\ \hline \end{array}$ |
| 815 | 373 |

OBJECTIVE

Demonstrate competence in subtraction with regrouping, minuends having up to four digits, subtrahends and differences to 999

RELATED ACTIVITIES

- Children may enjoy the challenge of drawing, illustrating, and solving word problems similar to the one on page 242.
- For practice in regrouping, have children use models or an abacus to represent a number such as 1234. Have the children regroup the models to show 10 more ones, and then 10 more tens. Then have the children record on a place-value chart the number of ones, tens, hundreds, and thousands to show the regrouping.
- For practice in subtraction and to prepare for relating addition and subtraction on pages 244-245, provide a work sheet showing subtraction exercises with missing numbers similar to the following.

$\begin{array}{r} \boxed{9} \boxed{4} \boxed{3} \\ - 421 \\ \hline 522 \end{array}$	$\begin{array}{r} \boxed{4} \boxed{3} \boxed{1} \\ - 50 \\ \hline 381 \end{array}$
$\begin{array}{r} \boxed{1} \boxed{4} \boxed{6} \boxed{2} \\ - 783 \\ \hline 679 \end{array}$	$\begin{array}{r} \boxed{1} \boxed{2} \boxed{3} \boxed{2} \\ - 694 \\ \hline 538 \end{array}$
$\begin{array}{r} \boxed{1} \boxed{3} \boxed{6} \boxed{4} \\ - 529 \\ \hline 835 \end{array}$	$\begin{array}{r} \boxed{1} \boxed{4} \boxed{2} \boxed{4} \\ - 974 \\ \hline 450 \end{array}$

Practice

Subtract.

- | | |
|--|--|
| 1. $\begin{array}{r} 118 \\ - 26 \\ \hline 92 \end{array}$ | 2. $\begin{array}{r} 1468 \\ - 721 \\ \hline 747 \end{array}$ |
| 3. $\begin{array}{r} 1406 \\ - 530 \\ \hline 876 \end{array}$ | 4. $\begin{array}{r} 66 \\ - 48 \\ \hline 18 \end{array}$ |
| 5. $\begin{array}{r} 984 \\ - 328 \\ \hline 656 \end{array}$ | 6. $\begin{array}{r} 1062 \\ - 828 \\ \hline 234 \end{array}$ |
| 7. $\begin{array}{r} 1728 \\ - 755 \\ \hline 973 \end{array}$ | 8. $\begin{array}{r} 115 \\ - 61 \\ \hline 54 \end{array}$ |
| 9. $\begin{array}{r} 62 \\ - 36 \\ \hline 26 \end{array}$ | 10. $\begin{array}{r} 884 \\ - 422 \\ \hline 462 \end{array}$ |
| 11. $\begin{array}{r} 1134 \\ - 817 \\ \hline 317 \end{array}$ | 12. $\begin{array}{r} 106 \\ - 94 \\ \hline 12 \end{array}$ |
| 13. $\begin{array}{r} 142 \\ - 73 \\ \hline 69 \end{array}$ | 14. $\begin{array}{r} 1632 \\ - 741 \\ \hline 891 \end{array}$ |
| 15. $\begin{array}{r} 107 \\ - 25 \\ \hline 82 \end{array}$ | 16. $\begin{array}{r} 457 \\ - 81 \\ \hline 376 \end{array}$ |
| 17. $\begin{array}{r} 1589 \\ - 645 \\ \hline 944 \end{array}$ | 18. $\begin{array}{r} 1270 \\ - 905 \\ \hline 365 \end{array}$ |
| 19. $\begin{array}{r} 1328 \\ - 343 \\ \hline 985 \end{array}$ | 20. $\begin{array}{r} 1119 \\ - 677 \\ \hline 442 \end{array}$ |
| 21. $\begin{array}{r} 1073 \\ - 528 \\ \hline 545 \end{array}$ | 22. $\begin{array}{r} 1225 \\ - 375 \\ \hline 850 \end{array}$ |
| 23. $\begin{array}{r} 1127 \\ - 270 \\ \hline 857 \end{array}$ | 24. $\begin{array}{r} 1382 \\ - 644 \\ \hline 738 \end{array}$ |

In some jobs, people work some distance from each other. But they talk to each other using walkie-talkies.



Police use walkie-talkies to help with parades.

Solve this problem.

- Officers Adams, Bell, Cook, and Day are working with a parade. Officer Adams is in charge. The officers place themselves like this along the street.



They use their walkie-talkies to tell Officer Adams how far they are from him.

Officer Bell is 450 m away, Officer Cook is 700 m away, and Officer Day is 900 m away.

How far is Officer Bell from Officer Day? **450 m**

PROBLEM SOLVING

242

LESSON ACTIVITY

Using the Page

- These exercises review subtraction concepts and skills. The exercises also provide an opportunity to determine if any children are having difficulty with subtraction and to locate the difficulty.

Remind the children to decide whether regrouping is necessary before they begin each exercise. Encourage them to keep the columns straight to avoid careless errors.

Problem Solving: Ask the children if they have used a walkie-talkie or seen one used. Read the information accompanying the photograph. Have the children copy the diagram. Then have them mark on the diagram the information that is given in the problem. Remind the children to read the question carefully and decide which information is necessary for solving the problem. (The distance between Officer Cook and Officer Adams does not influence the solution.)

LESSON OUTCOME

Subtract amounts of money with regrouping, minuends to \$19.99; solve related word problems

Materials

real money, play money, or copies of pages T351 and T352

Prerequisite Skills

Subtract amounts of money with regrouping, minuends to \$9.99; subtract with minuends having four digits

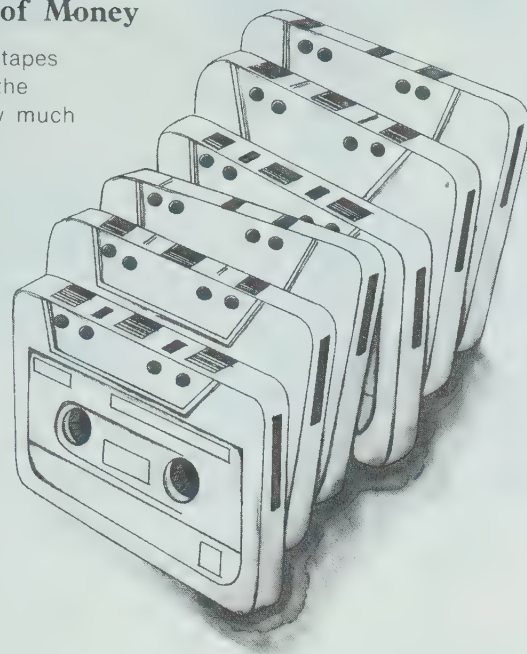
Checking Prerequisite Skills

Subtract.

- | | |
|---|---|
| 1. $\begin{array}{r} \$4.25 \\ - 1.84 \\ \hline \$2.41 \end{array}$ | 2. $\begin{array}{r} \$6.52 \\ - 5.73 \\ \hline \$0.79 \end{array}$ |
| 3. $\begin{array}{r} 1624 \\ - 984 \\ \hline 640 \end{array}$ | 4. $\begin{array}{r} 1357 \\ - 648 \\ \hline 709 \end{array}$ |

RELATED ACTIVITIES

• Present a picture of an object from a catalog. Have each child guess the price of the object and record her/his guess. Then state the actual price shown in the catalog and have each child determine and record the difference between her/his guess and the actual price. Repeat this for six other objects, recording each difference in a list. Then have each child add all the differences on her/his list. The child with the least sum is the winner.



Subtracting Amounts of Money

At the music store, a set of tapes costs \$12.45. Records with the same music cost \$8.90. How much more do the tapes cost?

$$\begin{array}{r} \text{Subtract } \$12.45 \\ - 8.90 \\ \hline \end{array}$$

Subtract the cents.
Regroup when needed.

Then subtract the dollars.

$$\begin{array}{r} \begin{array}{cc} 1 & 14 \end{array} \\ \$12.45 \\ - 8.90 \\ \hline \$3.55 \end{array}$$

The tapes cost \$3.55 more than the records.

Exercises

The store has a sale.

- The regular price for the records is \$8.90. The sale price is \$6.95. How much less is the sale price? **\$1.95**
- The regular price for the tapes is \$12.45. The sale price is \$9.29. How much less is the sale price? **\$3.16**
- The sale price for the tapes is \$9.29. The sale price for the records is \$6.95. How much more are the tapes? **\$2.34**

Subtract.

- | | |
|---|---|
| 4. $\begin{array}{r} \$16.79 \\ - 7.32 \\ \hline \$9.47 \end{array}$ | 5. $\begin{array}{r} \$12.43 \\ - 9.23 \\ \hline \$3.20 \end{array}$ |
| 6. $\begin{array}{r} \$13.66 \\ - 5.63 \\ \hline \$8.03 \end{array}$ | 7. $\begin{array}{r} \$11.13 \\ - 9.50 \\ \hline \$1.63 \end{array}$ |
| 8. $\begin{array}{r} \$15.72 \\ - 6.58 \\ \hline \$9.14 \end{array}$ | 9. $\begin{array}{r} \$11.18 \\ - 4.74 \\ \hline \$6.44 \end{array}$ |
| 10. $\begin{array}{r} \$18.38 \\ - 8.75 \\ \hline \$9.63 \end{array}$ | 11. $\begin{array}{r} \$14.80 \\ - 8.64 \\ \hline \$6.16 \end{array}$ |
| 12. $\begin{array}{r} \$13.50 \\ - 4.86 \\ \hline \$8.64 \end{array}$ | 13. $\begin{array}{r} \$15.07 \\ - 9.32 \\ \hline \$5.75 \end{array}$ |

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SON ACTIVITY

Using the Page

Write \$14.35 in the column labeled "Amount" on a chart similar to the following.

dollar bills	One-dollar bills	Dimes	Pennies	Amount
1	4	2	15	\$14.35

Have children select pennies, dimes, one-dollar bills, and ten-dollar bills to represent this amount. Record the number of each on the chart.

Ask the children how 10 more pennies can be obtained. Lead the children to suggest regrouping. Have a child replace 1 dime with 10 pennies. Record the regrouping on the chart as shown.

Use a similar procedure to obtain 10 more dimes, and then 10 more one-dollar bills. After each regrouping, emphasize that the same amount of money is named.

Using the Page

- Ask the children about buying tapes and records. Read the word problem for the worked example. Develop that subtraction is used to solve the problem.

Have the children begin the subtraction at the right and follow the subtracting of the cents. Ask children to explain regrouping 1 dollar as 10 dimes. Then have them subtract the dollars. Remind the children that the decimal point and the dollar sign should be shown in the answer. Read the concluding statement.

Exercises: Ask the children if they have ever bought things on sale. Explore their concept of a sale. Remind the children to show their subtraction for Ex. 1-3 and to answer in a sentence.

Assessment

Subtract.

- | | | |
|---|--|--|
| 1. $\begin{array}{r} \$8.64 \\ - 2.55 \\ \hline \$6.09 \end{array}$ | 2. $\begin{array}{r} \$15.72 \\ - 7.90 \\ \hline \$7.82 \end{array}$ | 3. $\begin{array}{r} \$19.60 \\ - 9.82 \\ \hline \$9.78 \end{array}$ |
|---|--|--|

LESSON OUTCOME

Use addition to check subtraction

Prerequisite Skills

Subtract with regrouping, minuends having up to four digits; add with regrouping, sums having up to four digits

Checking Prerequisite Skills

Subtract.

$$\begin{array}{r} 1. \quad 782 \\ - 399 \\ \hline 383 \end{array} \quad \begin{array}{r} 2. \quad 1643 \\ - 875 \\ \hline 768 \end{array}$$

Add.

$$\begin{array}{r} 3. \quad 236 \\ + 845 \\ \hline 1081 \end{array} \quad \begin{array}{r} 4. \quad 679 \\ + 658 \\ \hline 1337 \end{array}$$

Using Addition to Check Subtraction

Subtract 726 and add to check.

$$\begin{array}{r} \overset{11}{6} \overset{1}{7} \overset{16}{2} \\ - 478 \\ \hline 248 \end{array} \quad \begin{array}{r} 1 \quad 1 \\ 248 \\ + 478 \\ \hline 726 \end{array}$$

This sum should match the first number used in the subtraction. If they do not match, there is a mistake.

Working Together

Add to check each subtraction. Do the subtraction again if you find a mistake.

1. Subtract. Add to check.

$$\begin{array}{r} 765 \\ - 231 \\ \hline 534 \end{array} \quad \begin{array}{r} 534 \\ + 231 \\ \hline 765 \end{array}$$

2. Subtract. Add to check.

$$\begin{array}{r} \overset{511}{13} \overset{1}{8} \overset{16}{7} \\ - 524 \\ \hline 837 \end{array} \quad \begin{array}{r} 837 \\ + 524 \\ \hline 1361 \end{array}$$

Subtract. Add to check.

$$\begin{array}{r} 4. \quad 294 \quad 268 \\ - 26 \quad + 26 \\ \hline 268 \quad 294 \end{array} \quad \begin{array}{r} 5. \quad 910 \quad 483 \\ - 427 \quad + 427 \\ \hline 483 \quad 910 \end{array}$$

3. Subtract. Add to check.

$$\begin{array}{r} \overset{610}{17} \overset{1}{0} \overset{16}{8} \\ - 743 \\ \hline 865 \end{array} \quad \begin{array}{r} 865 \\ + 743 \\ \hline 1608 \end{array}$$

Be careful!

$$\begin{array}{r} 6. \quad 1336 \quad 845 \\ - 491 \quad + 491 \\ \hline 845 \quad 1336 \end{array} \quad \begin{array}{r} 7. \quad \$19.16 \quad \$9.56 \\ - 9.60 \quad + 9.60 \\ \hline \$9.56 \quad \$19.16 \end{array}$$

LESSON ACTIVITY

Using the Pages

- Direct the children's attention to the worked example. Have children explain the following steps in the subtraction example:

regrouping 1 ten as 10 ones, subtracting the ones, regrouping 1 hundred as 10 tens, subtracting the tens, and then subtracting the hundreds.

Have the children follow the arrows with their fingers. Emphasize the location of each number in the addition example.

Have the children explain the following steps in the addition example: adding the ones, regrouping 10 ones as 1 ten, adding the tens, regrouping 10 tens as 1 hundred, and adding the hundreds.

Compare the two numbers indicated by red. Discuss the relation between these two numbers. Develop that, just as basic addition and subtraction facts are inversely related, for every addition of two numbers there is a related

subtraction, and for every subtraction there is a related addition.

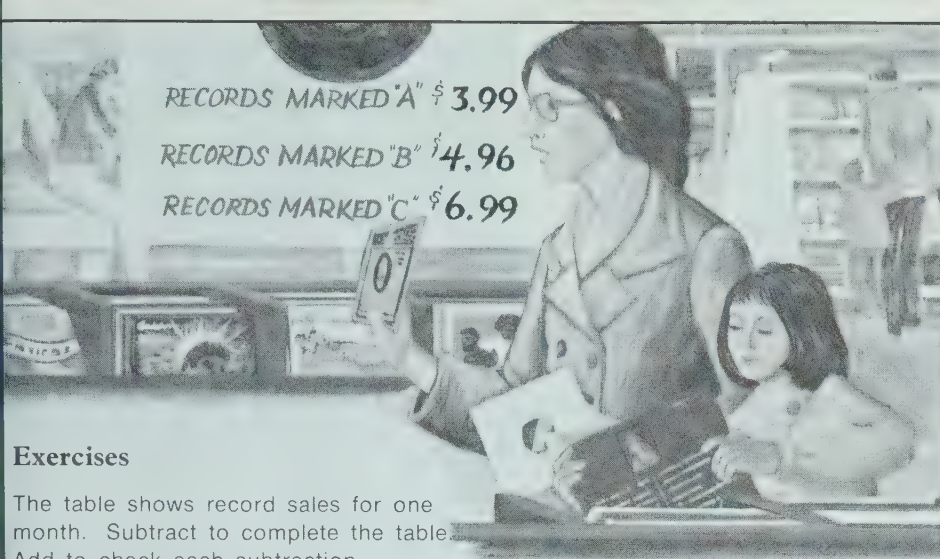
Read the information under the worked example. Ask children what they should do if the sum does not match the first number used in the subtraction. Lead the children to suggest that they should search for the error by checking each step.

Working Together: Have the children follow arrows for Ex. 1 and then add to check the subtraction. Ask if the subtraction is correct. Establish that since the sum matches the first number used in the subtraction, the subtraction is correct. For Ex. 2, have children explain how the two numbers in the addition are obtained. Then have them add to check the subtraction. Have the children complete the addition for Ex. 3 and compare the sum with the first number used in the subtraction. Ask why the two numbers are different. Challenge the children to find the mistake and add to check their subtraction. Have children explain the steps for Ex. 4-7. Remind them to write the dollar sign and the decimal point for Ex. 7.

RECORDS MARKED "A" \$3.99

RECORDS MARKED "B" \$4.96

RECORDS MARKED "C" \$6.99



Exercises

The table shows record sales for one month. Subtract to complete the table. Add to check each subtraction.

	1. "A" Records	2. "B" Records	3. "C" Records
Number at start of month	1735	1481	1360
Number at end of month	982	557	673
Number sold in the month	? 753	? 924	? 687

Solve. Add to check each subtraction.

4. 924 "B" records were sold. 687 "C" records were sold. How many more "B" records were sold? 237
 $+687$
 924
5. 753 "A" records were sold. 924 "B" records were sold. How many fewer "A" records were sold? 171
 171
 $+753$
 924

Subtract. Add to check.

6. $71 \begin{smallmatrix} 46 \\ -25 \\ \hline 46 \end{smallmatrix}$ $71 \begin{smallmatrix} 46 \\ -25 \\ \hline 46 \end{smallmatrix}$
7. $211 \begin{smallmatrix} 152 \\ -59 \\ \hline 152 \end{smallmatrix}$ $211 \begin{smallmatrix} 152 \\ -59 \\ \hline 152 \end{smallmatrix}$
8. $779 \begin{smallmatrix} 391 \\ -388 \\ \hline 391 \end{smallmatrix}$ $779 \begin{smallmatrix} 391 \\ -388 \\ \hline 391 \end{smallmatrix}$
9. $1592 \begin{smallmatrix} 739 \\ -853 \\ \hline 739 \end{smallmatrix}$ $1592 \begin{smallmatrix} 739 \\ -853 \\ \hline 739 \end{smallmatrix}$
10. $\$8.33 \begin{smallmatrix} \$3.49 \\ -4.84 \\ \hline \$3.49 \end{smallmatrix}$ $\$8.33 \begin{smallmatrix} \$3.49 \\ -4.84 \\ \hline \$3.49 \end{smallmatrix}$
11. $\$14.62 \begin{smallmatrix} \$7.65 \\ -6.97 \\ \hline \$7.65 \end{smallmatrix}$ $\$14.62 \begin{smallmatrix} \$7.65 \\ -6.97 \\ \hline \$7.65 \end{smallmatrix}$

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RELATED ACTIVITIES

- Children may work in pairs with one child completing a subtraction exercise. The other child uses addition to check the subtraction while the first child proceeds with the next subtraction. After a few exercises, have the children reverse roles.
- Children could use addition to check subtraction exercises they completed previously.
- A spinner similar to the one shown may be used to provide subtraction exercises. The number on the arrow is the first number in the subtraction exercise and the number on the dial is the second number. Have the children use addition to check each exercise.



Exercises: Through a general discussion, lead to the table for Ex. 1-3. Discuss how the table is designed. Ask the children why they are asked to subtract to complete the table. Lead them to realize that by subtracting the number of records at the end of the month from the number of records at the start of the month, they can find the number of records sold in the month. Then ask which numbers they would add to check the subtraction.

Have the children show the subtraction and addition for Ex. 4 and 5 and answer in a sentence.

Remind the children to find and correct the mistake, if the sum does not match the first number used in the subtraction.

Assessment

Subtract. Add to check.

1. $62 \begin{smallmatrix} 29 \\ -29 \\ \hline 62 \end{smallmatrix}$ $62 \begin{smallmatrix} 29 \\ -29 \\ \hline 62 \end{smallmatrix}$
2. $425 \begin{smallmatrix} 165 \\ -165 \\ \hline 425 \end{smallmatrix}$ $425 \begin{smallmatrix} 165 \\ -165 \\ \hline 425 \end{smallmatrix}$
3. $1292 \begin{smallmatrix} 847 \\ -847 \\ \hline 1292 \end{smallmatrix}$ $1292 \begin{smallmatrix} 847 \\ -847 \\ \hline 1292 \end{smallmatrix}$
4. $\$13.78 \begin{smallmatrix} \$5.69 \\ -5.69 \\ \hline \$13.78 \end{smallmatrix}$ $\$13.78 \begin{smallmatrix} \$5.69 \\ -5.69 \\ \hline \$13.78 \end{smallmatrix}$

LESSON OUTCOME

Subtract with regrouping for zero tens and/or zero hundreds in the minuend

Materials

two boxes with the mass marked in grams

Vocabulary

gram, g

Prerequisite Skills

Subtract with regrouping, minuends having up to four digits; subtract with amounts of money

Checking Prerequisite Skills

Subtract.

1.
$$\begin{array}{r} 674 \\ - 669 \\ \hline 5 \end{array}$$
2.
$$\begin{array}{r} 1382 \\ - 560 \\ \hline 822 \end{array}$$
3.
$$\begin{array}{r} 1567 \\ - 908 \\ \hline 659 \end{array}$$
4.
$$\begin{array}{r} 1412 \\ - 689 \\ \hline 723 \end{array}$$

Regrouping with Zeros

The Shreddies box shows that it holds 675 g (grams) of cereal. What other box holds enough cereal to make exactly 1 kg of cereal with the Shreddies?

Here are two ways to solve this problem:

1. Add the other amounts to 675 g and find the sum that equals 1000 g.
2. Subtract 1000 to find

$$\begin{array}{r} 1000 \\ - 675 \\ \hline \end{array}$$

how much more is needed to make 1000 g.

To subtract, think of 1000 as 100 tens, 0 ones. Regroup as 99 tens, 10 ones.

$$\begin{array}{r} 9910 \\ 1000 \\ - 675 \\ \hline \end{array}$$

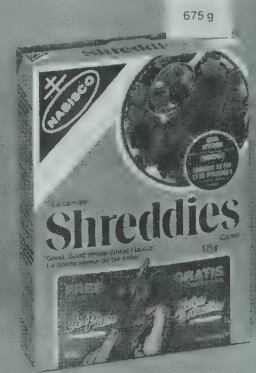
Then subtract place by place.

$$\begin{array}{r} 9910 \\ 1000 \\ - 675 \\ \hline 325 \end{array}$$

325 g more are needed to make 1 kg of cereal.

There are 325 g of Rice Flakes. The Shreddies and Rice Flakes together make 1 kg of cereal.

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1 kilogram equals 1000 grams.
1 kg = 1000 g

To check that 325 g is the amount that goes with 675 g to make 1000 g, add

$$\begin{array}{r} 325 \\ + 675 \\ \hline \end{array}$$

LESSON ACTIVITY

Before Using the Pages

- Display the two boxes. Explain that the symbol g means grams, which is a measurement of mass. Have children read the mass on each box. Ask which box has heavier contents.
- Write 1000 on a place-value chart. Ask for the number of thousands, hundreds, tens, and ones.

thousands	hundreds	tens	ones
1	0	0	0

Ask for and record the number of thousands, hundreds, tens, and ones that result from regrouping the one thousand as hundreds.

thousands	hundreds	tens	ones
0	10	0	0

Ask for and record the number of thousands, hundreds, tens, and ones that result from regrouping all the hundreds as tens.

thousands	hundreds	tens	ones
0	0	100	0

Ask for and record the number of thousands, hundreds, tens, and ones that result from regrouping 1 of the 100 as 10 ones.

thousands	hundreds	tens	ones
0	0	99	10

Emphasize that these are different ways of naming same number.

Using the Pages

- Read the thought cloud about the kilogram and the gram. Ask questions about the photograph such as:
 “Which box of cereal has the greatest (least) mass?”
 “Do any of the boxes of cereal have a mass greater than 1 kg? How can you tell?”
 Read the word problem for the worked example. Point out that there are two ways to solve the problem.



Working Together

Regroup 1 thousand as 99 tens and 10 more ones. Then subtract.

$$\begin{array}{r} 1. \quad 1000 \\ - 525 \\ \hline 475 \end{array} \quad \begin{array}{r} 2. \quad 1000 \\ - 186 \\ \hline 814 \end{array}$$

Subtract. Regroup when needed.

$$\begin{array}{r} 3. \quad 1000 \\ - 796 \\ \hline 204 \end{array} \quad \begin{array}{r} 4. \quad 1100 \\ - 842 \\ \hline 258 \end{array}$$

$$\begin{array}{r} 5. \quad 1004 \\ - 373 \\ \hline 631 \end{array} \quad \begin{array}{r} 6. \quad \$10.00 \\ - 6.04 \\ \hline \$3.96 \end{array}$$

Exercises

Subtract.

$$\begin{array}{r} 1. \quad 1000 \\ - 62 \\ \hline 938 \end{array} \quad \begin{array}{r} 2. \quad 1000 \\ - 740 \\ \hline 260 \end{array}$$

$$\begin{array}{r} 3. \quad 1050 \\ - 471 \\ \hline 579 \end{array} \quad \begin{array}{r} 4. \quad 1600 \\ - 933 \\ \hline 667 \end{array}$$

$$\begin{array}{r} 5. \quad 1704 \\ - 786 \\ \hline 918 \end{array} \quad \begin{array}{r} 6. \quad 1048 \\ - 255 \\ \hline 793 \end{array}$$

$$\begin{array}{r} 7. \quad \$10.00 \\ - 5.16 \\ \hline \$4.84 \end{array} \quad \begin{array}{r} 8. \quad \$10.05 \\ - 9.46 \\ \hline \$0.59 \end{array}$$

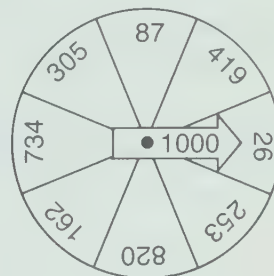
For each amount, how many more grams are needed to make 1 kg?

$$\begin{array}{ll} 9. \quad 350 \text{ g} & 650 \\ 10. \quad 275 \text{ g} & 725 \\ 11. \quad 450 \text{ g} & 550 \\ 12. \quad 325 \text{ g} & 675 \\ 13. \quad 525 \text{ g} & 475 \\ 14. \quad 475 \text{ g} & 525 \end{array}$$

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RELATED ACTIVITIES

• A spinner similar to the one shown may be used to provide subtraction exercises. Each number on the dial would be subtracted from the number on the arrow.



• To provide more practice in subtracting with zero, adapt the second activity on page T 103. Prepare work sheets with charts similar to the following and draw only three numeral cards.

1	0	0	0
-			

1	0	5	0
-			

• Encourage the children to find packages with labels showing mass in grams. These could be displayed for several days.

Discuss the first method of solving the problem. Point out that if addition is used to solve the problem, five exercises could be necessary.

Discuss the second solution. Lead the children to realize that only one subtraction exercise is necessary to find the answer.

Present the subtraction exercise in the second solution and point out that regrouping is certainly needed because 1000 has so many zeros. Relate the numerals and the explanations for each step of the worked example. If necessary refer to the regrouping on the board to show how 1000 equals 99 tens 10 ones. Point out how the regrouping is written. Have the children follow the subtracting of the ones, the tens, and then the hundreds.

Remind the children that addition can be used to check subtraction. Have children write the addition exercise on the board and add to check. Read the concluding statements.

Working Together: Remind the children how to record the regrouping. Have children read the instructions for Ex. 1

and 2. For Ex. 2, lead the children to realize that the 10 more ones are added to the 3 ones to give 13 ones. Ex. 6 requires regrouping with zeros when using an amount of money.

Exercises: Remind the children to regroup only when it is necessary. Ex. 9-14 reinforce the symbol g and the fact that 1 kg equals 1000 g. Ensure that the children record the symbol g with each answer for Ex. 9-14.

Encourage the children to check their answers by using addition.

Assessment

Subtract.

$$\begin{array}{r} 1. \quad 1000 \\ - 427 \\ \hline 573 \end{array} \quad \begin{array}{r} 2. \quad 1040 \\ - 434 \\ \hline 606 \end{array}$$

$$\begin{array}{r} 3. \quad 1006 \\ - 28 \\ \hline 978 \end{array} \quad \begin{array}{r} 4. \quad \$10.05 \\ - 8.07 \\ \hline \$1.98 \end{array}$$

OBJECTIVE






Demonstrate competence in subtraction with regrouping, minuends having up to four digits






Practice

Subtract.

- | | | | | |
|--|---|---|---|---|
| 1. $\begin{array}{r} 67 \\ - 42 \\ \hline 25 \end{array}$ | 2. $\begin{array}{r} 687 \\ - 61 \\ \hline 626 \end{array}$ | 3. $\begin{array}{r} 554 \\ - 250 \\ \hline 304 \end{array}$ | 4. $\begin{array}{r} 1377 \\ - 863 \\ \hline 514 \end{array}$ | 5. $\begin{array}{r} 478 \\ - 319 \\ \hline 159 \end{array}$ |
| 6. $\begin{array}{r} 283 \\ - 59 \\ \hline 224 \end{array}$ | 7. $\begin{array}{r} 735 \\ - 281 \\ \hline 454 \end{array}$ | 8. $\begin{array}{r} 64 \\ - 45 \\ \hline 19 \end{array}$ | 9. $\begin{array}{r} 115 \\ - 63 \\ \hline 52 \end{array}$ | 10. $\begin{array}{r} 1668 \\ - 674 \\ \hline 994 \end{array}$ |
| 11. $\begin{array}{r} 1232 \\ - 928 \\ \hline 304 \end{array}$ | 12. $\begin{array}{r} 154 \\ - 86 \\ \hline 68 \end{array}$ | 13. $\begin{array}{r} 1938 \\ - 943 \\ \hline 995 \end{array}$ | 14. $\begin{array}{r} 720 \\ - 595 \\ \hline 125 \end{array}$ | 15. $\begin{array}{r} 1602 \\ - 637 \\ \hline 965 \end{array}$ |
| 16. $\begin{array}{r} 1000 \\ - 544 \\ \hline 456 \end{array}$ | 17. $\begin{array}{r} 1053 \\ - 982 \\ \hline 71 \end{array}$ | 18. $\begin{array}{r} 403 \\ - 177 \\ \hline 226 \end{array}$ | 19. $\begin{array}{r} 1002 \\ - 483 \\ \hline 519 \end{array}$ | 20. $\begin{array}{r} 1050 \\ - 891 \\ \hline 159 \end{array}$ |
| 21. $\begin{array}{r} \$5.00 \\ - 2.06 \\ \hline \$2.94 \end{array}$ | 22. $\begin{array}{r} \$10.00 \\ - 9.69 \\ \hline \$0.31 \end{array}$ | 23. $\begin{array}{r} \$10.50 \\ - 0.95 \\ \hline \$9.55 \end{array}$ | 24. $\begin{array}{r} \$12.25 \\ - 7.60 \\ \hline \$4.65 \end{array}$ | 25. $\begin{array}{r} \$10.00 \\ - 7.58 \\ \hline \$2.42 \end{array}$ |

What would the calculator show for each difference?

26. 
 
 

27. 
 
 



LESSON ACTIVITY

Using the Pages

- Encourage understanding, accuracy, and speed for Ex. 1-25. Determine whether any difficulty is caused by not regrouping when needed, regrouping when not needed, not understanding regrouping, or forgetting subtraction facts. Provide more practice, if necessary. Remind the children that they can use addition to check any answer they wish to verify.
Review how to write the calculator digits for Ex. 26 and 27.
- Ask the children to comment on the picture on page 249. Have children read and discuss the poem. Ensure that they understand how to solve the riddle. They may enjoy relating the answer and the picture.

You can solve the riddle
if you are a good subtracter.

When you study science,
I know you hear the notion
That sometime in the future
We'll be farming in the ocean.

I haven't been invented yet,
But surely I'll be needed
To mow the seaweed, dig the clams,
Have oyster beds well-seeded.

What kind of machine am I?

Answer: $\begin{array}{r} 838 \\ - 750 \\ \hline 838 \end{array}$ $\begin{array}{r} 873 \\ - 108 \\ \hline 765 \end{array}$ $\begin{array}{r} 387 \\ - 409 \\ \hline -22 \end{array}$ $\begin{array}{r} 787 \\ - 41 \\ \hline 746 \end{array}$ $\begin{array}{r} 783 \\ - 362 \\ \hline 421 \end{array}$ $\begin{array}{r} 378 \\ - 568 \\ \hline -190 \end{array}$ $\begin{array}{r} 838 \\ - 127 \\ \hline 711 \end{array}$ $\begin{array}{r} 837 \\ - 568 \\ \hline 269 \end{array}$ $\begin{array}{r} 783 \\ - 362 \\ \hline 421 \end{array}$ $\begin{array}{r} 383 \\ - 117 \\ \hline 266 \end{array}$ $\begin{array}{r} 378 \\ - 557 \\ \hline -179 \end{array}$

Subtract to find the letters that
replace the numbers in the Answer.

A $\begin{array}{r} 1588 \\ - 750 \\ \hline 838 \end{array}$	B $\begin{array}{r} 895 \\ - 108 \\ \hline 787 \end{array}$	C $\begin{array}{r} 1246 \\ - 409 \\ \hline 837 \end{array}$	D $\begin{array}{r} 690 \\ - 313 \\ \hline 377 \end{array}$	E $\begin{array}{r} 903 \\ - 165 \\ \hline 738 \end{array}$
G $\begin{array}{r} 1000 \\ - 227 \\ \hline 773 \end{array}$	I $\begin{array}{r} 1687 \\ - 809 \\ \hline 878 \end{array}$	L $\begin{array}{r} 819 \\ - 41 \\ \hline 778 \end{array}$	M $\begin{array}{r} 1239 \\ - 362 \\ \hline 877 \end{array}$	O $\begin{array}{r} 500 \\ - 117 \\ \hline 383 \end{array}$
P $\begin{array}{r} 907 \\ - 170 \\ \hline 737 \end{array}$	R $\begin{array}{r} 700 \\ - 322 \\ \hline 378 \end{array}$	S $\begin{array}{r} 1000 \\ - 127 \\ \hline 873 \end{array}$	T $\begin{array}{r} 1351 \\ - 568 \\ \hline 783 \end{array}$	U $\begin{array}{r} 944 \\ - 557 \\ \hline 387 \end{array}$

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RELATED ACTIVITIES

- Children may enjoy the challenge of creating riddles similar to the one on page 249. The pictures in Unit 13 or a topic in social studies could provide a basis for the riddles. These could be collected in a book for others to solve.
- Have the children use addition to check their answers for Ex. 1-25 on page 248.
- To review subtraction facts, cards similar to the following could be used for the game "Dominoes" on page T 349.

13 - 7	5	14 - 9	8
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OBJECTIVE

Find the missing information for a problem, and then solve the problem

RELATED ACTIVITIES

- Encourage children to report situations in which they cannot find solutions because they lack information. They may then be directed to reference books or other sources for the necessary data.
- Children may illustrate the problems on page 250.
- Children may enjoy the challenge of creating and solving word problems similar to those on page 250, writing their own problems, or rewriting other word problems in their mathematics textbook.

Finding the Missing Information

For each problem,

- what information is missing?
- tell how to find the missing information.
- tell how to solve the problem.

Example:

Leslie baked some cookies. She ate 5 and left the others on the table.
How many cookies did she bake?

How many cookies are on the table?

Count them.

Add 5 and the number on the table to find how many cookies she baked.

missing information

how to find it

how to solve the problem

Solutions will vary.

1. Ty wants to buy a model car. He has 10¢. How much more does he need for the model car?
How much does the model car cost?
2. There are 14 clean socks. The others need washing. How many socks are there?
How many need washing?
3. Which book has more pages, your reader or this book?
How many pages are in your reader?
4. Who is taller, the tallest boy or the tallest girl in your class? How much taller?
How many are the tallest boy and the tallest girl?
5. A box held 200 tissues when it was opened. How many tissues have been taken from the box?
How many tissues are in the box now?
6. Are there more girls or more boys absent from class today?
How many boys and how many girls are absent?
7. Each child in the room was given one apple. There were 8 apples left over. How many apples were there to give away?
How many children are in the room?
8. Each bag holds 15 oranges. One bag is partly filled. How many more oranges will this bag hold?
How many oranges are in the bag?
9. Is the distance greater around your head or a friend's head? How much greater?
What is the distance around your head? What is the distance around a friend's head?
10. Kay has 25¢ left from her allowance. How much has Kay used from her allowance?
How much is Kay's allowance?
11. Which is greater, the distance from the top of your head to your heels, or from finger tip to finger tip with arms outstretched?
What is the distance from the top of your head to your heels? What is the distance from finger tip to finger tip with arms outstretched?

PROBLEM SOLVING

250

LESSON ACTIVITY

Before Using the Page

- Tell the children that there were some records in a box and then two were taken out of the box. Ask how many records are still in the box. Lead the children to realize that they do not have enough information to answer the question. Ask what information is missing and discuss how to find it.

Using the Page

- Read the word problem for the worked example. Have the children follow the instructions to establish what the missing information is, how to find it, and then how to use it to solve the problem.

Note that the children are asked to tell how to solve the problems, not to actually solve them.

- This page may be used in different ways.

The class may discuss each problem together and suggest ways to find the missing information.

You may wish to divide the class into small groups with a leader for each group. Each group could discuss problems as you move from group to group listening their ideas. This would give more children an opportunity to offer suggestions. The leader of each group could report to the class after the discussion.

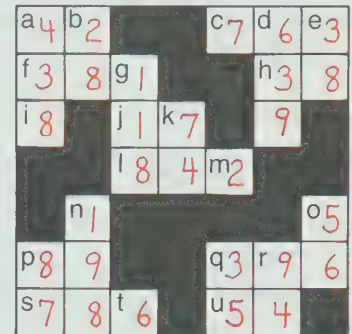
Although this lesson is mainly for discussion, so children may wish to write their suggestions for a selection of the problems.

OBJECTIVE

Demonstrate an understanding of the concepts and skills presented in this unit

RELATED ACTIVITIES

• To provide more practice in subtraction, prepare copies of the following cross-number puzzle. (Copies of page T 365 can be used for the puzzle.)



Across

- a. 126 - 84
c. 1144 - 381
f. 680 - 299
h. 230 - 192
i. 475 - 467
j. 1003 - 986
l. 1095 - 253
n. 1000 - 999
o. 494 - 489
p. 165 - 76
q. 523 - 127
s. 1034 - 248
u. 1040 - 986

Down

- a. 987 - 549
b. 490 - 462
c. 873 - 866
d. 767 - 128
e. 529 - 491
g. 1070 - 952
k. 204 - 130
m. 101 - 99
n. 407 - 209
o. 508 - 452
p. 468 - 381
r. 118 - 24
t. 55 - 49

251

Checking Up

Subtract.

- | | | | |
|---|--|--|--|
| 1. $\begin{array}{r} 458 \\ -125 \\ \hline 333 \end{array}$ | 2. $\begin{array}{r} 62 \\ -47 \\ \hline 15 \end{array}$ | 3. $\begin{array}{r} 336 \\ -142 \\ \hline 194 \end{array}$ | 4. $\begin{array}{r} 429 \\ -85 \\ \hline 344 \end{array}$ |
| 5. $\begin{array}{r} 631 \\ -363 \\ \hline 268 \end{array}$ | 6. $\begin{array}{r} 305 \\ -167 \\ \hline 138 \end{array}$ | 7. $\begin{array}{r} 200 \\ -88 \\ \hline 112 \end{array}$ | 8. $\begin{array}{r} 422 \\ -229 \\ \hline 193 \end{array}$ |
| 9. $\begin{array}{r} 1257 \\ -438 \\ \hline 819 \end{array}$ | 10. $\begin{array}{r} 1737 \\ -852 \\ \hline 885 \end{array}$ | 11. $\begin{array}{r} 1549 \\ -773 \\ \hline 776 \end{array}$ | 12. $\begin{array}{r} 1359 \\ -831 \\ \hline 528 \end{array}$ |
| 13. $\begin{array}{r} 1654 \\ -926 \\ \hline 728 \end{array}$ | 14. $\begin{array}{r} 1000 \\ -297 \\ \hline 703 \end{array}$ | 15. $\begin{array}{r} 1043 \\ -776 \\ \hline 267 \end{array}$ | 16. $\begin{array}{r} 1443 \\ -909 \\ \hline 534 \end{array}$ |
| 17. $\begin{array}{r} \$4.55 \\ -1.27 \\ \hline \$3.28 \end{array}$ | 18. $\begin{array}{r} \$12.00 \\ -4.73 \\ \hline \$7.27 \end{array}$ | 19. $\begin{array}{r} \$11.05 \\ -2.55 \\ \hline \$8.50 \end{array}$ | 20. $\begin{array}{r} \$10.00 \\ -4.16 \\ \hline \$5.84 \end{array}$ |

Solve.

- | | |
|---|---|
| 21. The large tin has 625 ml of soup. The small tin has 450 ml of soup. How much more soup is there in the large tin? 175 mL | 22. There are 325 g of peanuts in the bowl. How many more grams are needed to make 1 kg (1000 g) of peanuts? 675 |
| 23. A jumbo jet can carry 365 passengers. There are 77 empty seats on one flight. How many passengers are on the flight? 288 | 24. On one trip the airplane flew 1475 km. It flew 855 km on a second trip. How much shorter was the second trip? 620 km |
| 25. 1300 tickets were put on sale. Two days later 315 tickets were left. How many had been sold? 985 | 26. There are 1275 seats in the gym. 985 seats are taken. How many seats are not taken? 290 |
| 27. The regular price is \$8.75. The sale price is \$5.89. How much less is the sale price? \$2.86 | 28. The sale price is \$5.89. How much money does a buyer get back from \$10.00? \$4.11 |
| 29. A jacket costs \$9.90. Ron has saved \$7.25. How much more does Ron need for the jacket? \$2.65 | 30. Don had \$11.40. He spent \$9.90 for the jacket. How much money does Don have left? \$1.50 |

Skills	Exercises	Related Pages
Subtract, minuends having two digits	2	
Subtract, minuends having three digits	1, 3-8	
Subtract, minuends having four digits	9-16	T 264-T 265
Subtract, amounts of money	17-20	T 267
Subtract, regrouping with zero tens and/or zero hundreds	6,7,14,15	T 270-T 271
Solve subtraction problems	21-30	

exercises and the necessary regrouping with models for thousands, hundreds, tens, and ones. Children may require more practice in regrouping with zero in place-value charts.

By watching the children complete the exercises, you will be able to determine whether they subtract the ones first, then the tens, and then the hundreds. If children do not follow this order of subtracting, review the reasons why it is important.

Children benefit from frequent practice of basic subtraction facts. Activities and games suggested in Unit 13 and in preceding units may be used for reinforcement.

Ensure that the children write the dollar signs and the decimal points for Ex. 17-20 and Ex. 27-30. Check also that they include mL in the sentence answering Ex. 21, g for Ex. 22, km for Ex. 24.

Comments

Determine whether errors in regrouping are caused by regrouping when not necessary, by not regrouping when necessary, or by regrouping incorrectly. Children having difficulty with regrouping may benefit from showing subtraction

Unit 14 Overview

Decimals

This unit reviews the use of decimals for showing wholes and tenths, first introduced in Unit 7. The place-value aspect of ones and tenths is given greater emphasis at this time. Subtraction of decimals is introduced and this involves the regrouping of 1 one as 10 tenths. Decimal notation is extended to hundredths. However, hundredths are treated on their own as parts of a whole that has been divided into one hundred equal parts. No attempt is made to relate tenths and hundredths formally. Application of hundredths is examined in the relationships between dollars and cents, and metres and centimetres. As in Unit 7, concrete models assist in the development of concepts presented in this unit.

Prerequisite Skills

- read and write decimal notation from 0.0 to 9.9
- add decimals with regrouping, sums to 9.9
- demonstrate an understanding of the relationship between centimetres and metres
- subtract two-digit numbers with regrouping
- write amounts of money using dollar and cents notation

Unit Outcomes

- subtract decimals with regrouping, minuends to 9.9
- read and write decimal notation from 0.00 to 9.99
- identify cents as hundredths of a dollar; express amounts of money in cents and in dollars
- express metres as centimetres and centimetres as metres using decimals

Background

In Unit 7 it was shown that fractional parts which are expressed in tenths can be expressed conveniently using decimal notation. Numerals such as 0.9 and 4.2 were encountered and these were read “nine-tenths” and “four and two-tenths”. This manner of reading numerals helped to emphasize the aspect of ten equal parts of a whole for one-place decimals and to reinforce the understanding of place value. The decimal point was seen as separating wholes from parts of a whole. The number to the right of the decimal point thus names an amount less than one, and the number to the left names an amount greater than one. In summary, tenths are expressed as one-place decimals.

Addition of one-place decimals was also introduced in Unit 7. This involved regrouping 10 tenths as 1 one, and the procedure was related to addition of two-digit whole numbers with regrouping. In this unit, subtraction of decimals is introduced for minuends to 9.9, and children are involved in regrouping 1 one as 10 tenths. The procedure can be considered as an extension of subtraction with two-digit whole numbers for which 1 ten is regrouped as 10 ones. For example, just as 6 tens 3 ones can be regrouped as 5 tens 13 ones, so 6 ones 3 tenths can be regrouped as 5 ones and 13 tenths to facilitate subtraction.

$$\begin{array}{r} 5 \text{ } 13 \\ \cancel{6} \cancel{3} \\ - 2 \text{ } 9 \\ \hline 3 \text{ } 4 \end{array} \qquad \begin{array}{r} 5 \text{ } 13 \\ \cancel{6} \cancel{3} \\ - 2 \text{ } 9 \\ \hline 3 \text{ } 4 \end{array}$$

The regrouping procedure can be illustrated using the concrete models described in the Overview for Unit 7. The practice exercises that follow the introduction of subtraction with tenths provide practice with both operations of addition and subtraction. Since they are inverse operations, the regrouping procedure used for one is the reverse of the regrouping procedure used for the other, and the two concepts can reinforce each other. Note that 0 is important as a place-holder in subtraction with decimals. Contrast the following subtraction with decimals with the corresponding subtraction with whole numbers. The zero in the ones' place for 0.8 is needed in example A, whereas subtracting the tens in example B, the zero for 0 tens is not written.

$$\begin{array}{r} \text{A} \quad 1 \text{ } 15 \\ \quad \cancel{2} \cancel{8} \\ - 1 \text{ } 7 \\ \hline 0 \text{ } 8 \end{array} \qquad \begin{array}{r} \text{B} \quad 1 \text{ } 15 \\ \quad \cancel{2} \cancel{8} \\ - 1 \text{ } 7 \\ \hline 8 \end{array}$$

With sufficient practice, children can see that the process of regrouping in addition or in subtraction is no different for decimals than for whole numbers. The decimal point is merely a marker to separate the whole-number part from the fractional part of the numeral.

Hundredths are introduced as a separate concept. That is, an attempt is made to relate hundredths and tenths. One-place decimals refer to parts of a whole which has ten equal parts. Now, two-place decimals are introduced to represent parts of a whole which has one hundred equal parts. Thus, 4 wholes and 13 hundredths of a whole is written 4.13 and is read “four and thirteen-hundredths”. Similarly, 0 wholes and 9 hundredths of a whole is written 0.09 and is read “nine-hundredths” or “zero wholes and nine-hundredths”. The same model that was divided into ten equal parts in Unit 7 is now seen divided into one hundred equal parts. Although some children will likely recognize that one-tenth shows the same amount as ten hundredths, this concept is left for development at a later level when a closer examination of the place values will reveal the ten-to-one relationship.

In writing numerals for numbers less than ten-hundredths, zero in the tenths' place is very important. This concept can be developed in an informal manner through decimal number patterns similar to the following. Children can observe the changing pattern of the digits in a particular column for each pattern.

13 hundredths	0.13	67 hundredths	0.67
12 hundredths	0.12	57 hundredths	0.57
11 hundredths	0.11	47 hundredths	0.47
10 hundredths	0.10	37 hundredths	0.37
9 hundredths	0.09	27 hundredths	0.27
8 hundredths	0.08	17 hundredths	0.17
7 hundredths	0.07	7 hundredths	0.07

The concept of 0 in the tenths' place for numbers less than ten-hundredths can be supported further by the following considerations:

A one-place decimal shows tenths. Thus, a numeral such as 0.9 names nine-tenths.

A two-place decimal shows hundredths. Thus, 0.90 names ninety-hundredths, and 0.09 names nine-hundredths.

In previous work with measuring lengths, children experienced that 100 cm is the same length as 1 m. Since 1 cm is one hundred equal parts of a metre, the part-of-the-whole concept may be used as an approach to the use of decimals to express centimetres as metres; for example,

125 cm
is 1 m and 25 of 100 equal parts of a metre, or
1 and 25 hundredths m, or
1.25 m.

The place-value concept can offer a different approach because 1 cm is 0.01 m, and 100 cm can be regrouped as 1 m; for example,

125 cm
is 125 hundredths m, or
1 and 25 hundredths m, or
1.25 m.

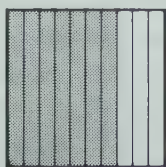
Before this time, children have been aware of a “dot” separating dollars from cents in notation such as \$1.25. The significance of the dot may be explained at this time in terms of hundredths and two-place decimals. Approaches similar to the ones described above for the metre-centimetre relationship may be used. For example, since 1¢ is 1 hundredth the value of a dollar, 125¢ is 125 hundredths of a dollar, which can be regrouped as 1 dollar and 25 hundredths of a dollar. This is 1.25 dollars, which we write as \$1.25. Alternatively, 125¢ is 1 dollar and 25¢, which is the same as 1 dollar and 25 hundredths of a dollar. This, again, is 1.25 dollars, written \$1.25.

Teaching Strategies

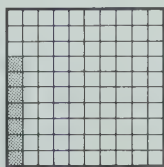
Units 11 to 13 provided an opportunity to review the place-value structure of our numeration system for whole numbers (hundreds, tens, and ones). It may now be reviewed in the work of Unit 7 that parts of a whole can be expressed along with a number of wholes, if the parts are expressed as tenths, and a decimal point separates the wholes from the tenths. Review the decimal notation for tenths and have children use concrete models to represent numbers such as 0.4 and 3.8. Have them explain the difference for pairs of numerals such as 4.2 and 8 and 0.8. Refer to the number line to compare decimals and to review the concept of order.

Prior to the work on subtraction of tenths it would be helpful to review addition of tenths and the regrouping of 10 tenths as 1 whole. Then, a review of subtraction of whole numbers for two-digit minuends with regrouping can prepare children for regrouping in subtraction with tenths. The exercises should be supported with concrete models as illustrated on page 254.

For the concept of hundredths, give children the opportunity to color diagrams for hundredths (see the description below). These diagrams can then serve as models in activities for which children represent given numbers such as 3.21, 0.42, and 0.07. The models together with those for tenths from Unit 7 will be helpful for showing the meaning of decimals such as 0.7 and 0.07.



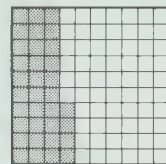
0.7



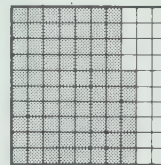
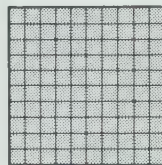
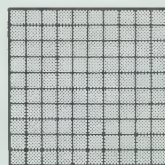
0.07

Models for Ones and Hundredths

To represent two-place decimals make white models and blue models with copies of page T364. For decimals less than one, color blue the appropriate number of hundredths on a white model. For example, to show 0.34, color 34 of the 100 squares blue. For decimals greater than one, show the required number of blue whole models, and color blue the appropriate number of hundredths on a white model. For example, to show 2.76, display two blue whole models and color 76 of the 100 squares blue on a white model.



0.34



2.76

Materials

models for ones and tenths prepared from copies of page T363 as described in the Overview for Unit 7
models for ones and hundredths as described above
model for 0.15 made as described above
measuring tapes and metre sticks marked in centimetres
objects to be measured in centimetres

Vocabulary

uneven bars
balance beam

floor exercises
vault

obstacle
hundredths

LESSON OUTCOME

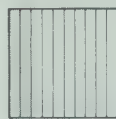
Read and write decimal notation from 0.0 to 9.9

Materials

models for ones and tenths prepared from copies of page T 363 as described in the Overview for Unit 7

14 DECIMALS

Using Decimals to Show Wholes and Tenths – Review



4 wholes and
2 of 10 equal parts
of another whole
is written

$$4\frac{2}{10} \text{ or } 4.2$$

four and two-tenths

ones	tenths
4	2



0 wholes and
6 of 10 equal parts
is written

$$\frac{6}{10} \text{ or } 0.6$$

six-tenths

ones	tenths
0	6

Working Together

Give the decimal
that shows how much
is shaded.

1. 2.8



252

Write the decimals.

2.

ones	tenths
8	4

 8.4

3.

ones	tenths
0	9

 0.9

4. six and two-tenths 6.2

5. eight-tenths 0.8

6. four and one-tenth 4.1

7. five and nine-tenths 5.9

Write the words.

8. 2.7 two and seven-tenths

9. 0.4 four-tenths

10. 3.0 three and zero-tenths or three

LESSON ACTIVITY

Before Using the Pages

- Use the display models suggested in *Materials* to show seven-tenths. Ask:

“Are the parts equal?”

“How many parts are shown?”

“How many parts are blue?”

“How can you express the number of parts that are blue?”

Depending on the children’s answers, the opportunity may arise to show both the fraction and the decimal for seven-tenths. Note that the two numerals name the same amount. (The answers for these questions, especially for the last question, will indicate what review is necessary.)

Use the models to show two and five-tenths. Ask for the number of wholes, and then, referring to the part of the model showing tenths, ask the questions suggested for seven-tenths.

Using the Pages

- Direct the children’s attention to the illustration for four and two-tenths. Ask, “How many wholes are shown?” The direct the children’s attention to the diagram that is partial blue. Ask:

“Are the parts equal?”

“How many parts are shown?”

“How many of these parts are blue?”

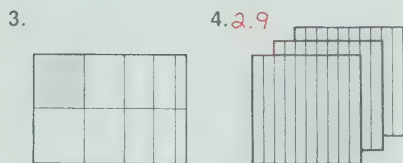
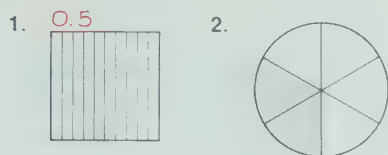
“How many tenths are blue?”

Discuss the different ways of expressing this amount. Review how the place-value chart can be used to show tenths. Review that the same word name is used for the fraction and for the decimal. Review the position of the decimal point between the digit that indicates wholes and the digit that indicates parts of a whole, that is, between the ones’ place and the tenths’ place.

Consider the illustration for six-tenths. Ask the same questions as for the preceding example. Compare the way of writing the wholes and the ways of writing the tenths.

Exercises

For each picture that shows 10 equal parts, write a decimal to show how much is shaded.



Write the decimals.



5. 3 5
7. three-tenths 0.3
8. two and six-tenths 2.6
9. one-tenth 0.1

10. four and eight-tenths 4.8
11. eight and one-tenth 8.1
12. five and five-tenths 5.5

Write the words.

13. 1.5 14. 0.1 15. 2.2
16. 0.9 17. 3.7 18. 4.3

Show each amount with a decimal.

19. Marty ate three-tenths of the pie. 0.3
20. Tina used two and six-tenths bottles of paint. 2.6

13. one and five-tenths 14. one-tenth 15. two and two-tenths
16. nine-tenths 17. three and seven-tenths 18. four and three-tenths

Add.

1. $\begin{array}{r} 36 \\ + 22 \\ \hline 58 \end{array}$	2. $\begin{array}{r} 652 \\ + 36 \\ \hline 688 \end{array}$	3. $\begin{array}{r} 430 \\ + 541 \\ \hline 971 \end{array}$
4. $\begin{array}{r} 25 \\ + 19 \\ \hline 44 \end{array}$	5. $\begin{array}{r} 281 \\ + 32 \\ \hline 313 \end{array}$	6. $\begin{array}{r} 742 \\ + 903 \\ \hline 1645 \end{array}$
7. $\begin{array}{r} 78 \\ + 25 \\ \hline 103 \end{array}$	8. $\begin{array}{r} 945 \\ + 81 \\ \hline 1026 \end{array}$	9. $\begin{array}{r} 527 \\ + 647 \\ \hline 1174 \end{array}$

Add. Remember to regroup 10 tenths as 1 one.

10. $\begin{array}{r} 3.6 \\ + 2.2 \\ \hline 5.8 \end{array}$	11. $\begin{array}{r} 2.1 \\ + 2.5 \\ \hline 4.6 \end{array}$	12. $\begin{array}{r} 3.2 \\ + 0.5 \\ \hline 3.7 \end{array}$
13. $\begin{array}{r} 2.5 \\ + 1.9 \\ \hline 4.4 \end{array}$	14. $\begin{array}{r} 4.3 \\ + 2.7 \\ \hline 7.0 \end{array}$	15. $\begin{array}{r} 4.6 \\ + 3.8 \\ \hline 8.4 \end{array}$
16. $\begin{array}{r} 6.8 \\ + 2.5 \\ \hline 9.3 \end{array}$	17. $\begin{array}{r} 3.0 \\ + 3.5 \\ \hline 6.5 \end{array}$	18. $\begin{array}{r} 4.5 \\ + 0.7 \\ \hline 5.2 \end{array}$
19. $\begin{array}{r} 4.7 \\ + 4.6 \\ \hline 9.3 \end{array}$	20. $\begin{array}{r} 2.3 \\ + 5.1 \\ \hline 7.4 \end{array}$	21. $\begin{array}{r} 3.9 \\ + 5.5 \\ \hline 9.4 \end{array}$

Subtract.

22. $\begin{array}{r} 49 \\ - 23 \\ \hline 26 \end{array}$	23. $\begin{array}{r} 427 \\ - 116 \\ \hline 311 \end{array}$	24. $\begin{array}{r} 756 \\ - 545 \\ \hline 211 \end{array}$
25. $\begin{array}{r} 72 \\ - 26 \\ \hline 46 \end{array}$	26. $\begin{array}{r} 111 \\ - 70 \\ \hline 41 \end{array}$	27. $\begin{array}{r} 604 \\ - 381 \\ \hline 223 \end{array}$
28. $\begin{array}{r} 831 \\ - 764 \\ \hline 67 \end{array}$	29. $\begin{array}{r} 642 \\ - 253 \\ \hline 389 \end{array}$	30. $\begin{array}{r} 703 \\ - 488 \\ \hline 215 \end{array}$
31. $\begin{array}{r} 1659 \\ - 912 \\ \hline 747 \end{array}$	32. $\begin{array}{r} 1390 \\ - 679 \\ \hline 711 \end{array}$	

KEEPING SHARP

RELATED ACTIVITIES

- Have the children start a display showing examples of decimals. They may have found more examples since completing Unit 7. By adding to the display each day, the children can reinforce the concepts from Unit 14.
- Activities suggested for Unit 7 may be used to review concepts that are presenting difficulty.
- If the cards were made for the second activity on page T135, they could be used for the game "Concentration" on page T349.
- Children may enjoy playing a game similar to tick-tack-toe. One player may write the numerals 0.1, 0.3, 0.5, or 0.7 only. The other player may write the numerals 0.2, 0.4, 0.6, or 0.8 only. Each numeral may be used any number of times. Not all the numerals must be used. The two players take turns each writing one of her/his numerals in a square until three numbers in line have a sum of 1.5. The player who writes the last of the numbers required for a sum of 1.5 is the winner.
- Read a list of decimals for the children to write each numeral (or the word name).
- The game "Product Search" on page T350 could be adapted for addition of decimals.

Point out that a zero is written to the left of the decimal point in the decimal numeral to show zero wholes. Emphasize that both $\frac{6}{10}$ and 0.6 indicate the same amount.

Working Together: These exercises provide the opportunity to determine the children's understanding of decimals for a model (Ex. 1), for a place-value chart (Ex. 2 and 3), and for written expressions (Ex. 4-10). Review the position of the decimal point between the wholes and the parts, that is, between the ones and the tenths. Remind the children to record zero wholes for Ex. 3 and 5. Review the use of the word "and" and the hyphen in the word names for tenths.

Exercises: For the pictures for Ex. 1-4 not showing ten equal parts, you may wish to have the children write "No" and explain the reason for that answer. (There are not ten parts or the ten parts are not equal.) You may also have the children explain their answers for Ex. 5-18 in terms of the number of wholes and the number of tenths.

Keeping Sharp: These exercises show that the same procedure is used for adding decimals as for adding whole numbers.

Draw the children's attention to the similarity of pairs of exercises as Ex. 1 and 10 and Ex. 4 and 13.

Assessment

Write the decimals.

1.

ones	tenths
4	5

 4.5

2. eight-tenths 0.8 3. six and one-tenth 6.1

Write the words.

4. 2.3 5. 0.7 seven-tenths
two and three-tenths

LESSON OUTCOME

Subtract decimals with regrouping, minuends to 9.9

Materials

models for ones and tenths prepared from copies of page T 363

Prerequisite Skills

Write decimal notation from 0.0 to 9.9; subtract two-digit numbers with regrouping

Checking Prerequisite Skills

Write the decimals.

1.

ones	tenths
0	6

0.6
2. five and two-tenths
 5.2
3. four-tenths
 0.4

Subtract.

4.

23
– 16
7
5.

40
– 37
3

Background

Using the place-value aspect of decimals shortens the traditional presentation of the algorithm for subtracting decimals. The method on page 254 presents subtraction as an extension of regrouping. It replaces expressing decimals as fractions with denominators of ten to explain the algorithm. Subtraction with decimals requires the same process as subtraction with whole numbers.

LESSON ACTIVITY

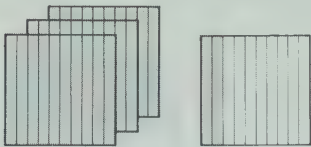
Before Using the Pages

- To lead the children to realize that subtraction with decimals is an extension of subtraction with whole numbers, provide the following warm-up experiences. Write 2.5 on a place-value chart as shown. Have the children use their models to represent 2.5. Write 1.2 on the place-value chart as the second number for the subtraction. Ask what number is represented by 1.2. Have the children remove 2 tenth-strips from their models to represent subtracting the tenths. Ask for and record the difference in the tenths' place. Use a similar procedure for subtracting the ones. Finally, ask for and record below the chart the number represented by 1 one and 3 tenths.

ones	tenths
2	5
– 1	2
1	3
1.3	

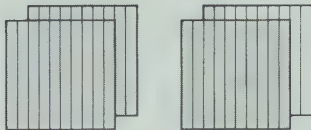
Subtracting Decimals

Subtract 1.5 from 3.2.



	ones	tenths
	3	2
–	1	5

Show 3.2 and 1.5 with their ones and tenths lined up. Show the greater number first.



	2	12
	3	2
–	1	5

Cannot subtract 5 tenths from 2 tenths. Regroup 3 ones, 2 tenths as 2 ones, 12 tenths.



	2	12
	3	2
–	1	5
	7	

Subtract the tenths.



	2	12
	3	2
–	1	5
	1.7	

Subtract the ones and place the decimal point.

1.5 subtracted from 3.2 is 1.7.

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Repeat this procedure with 0.4 – 0.2. Point out that there are no ones for either number.

- Write 3.1 on a place-value chart as shown. Ask the children how this number could be represented using only 2 ones. Lead them to realize that 1 one can be regrouped as 10 tenths. Have the children regroup their models by replacing one model for ones with a model for 10 tenths (10 tenth-strips placed on a model for one). Record the regrouping on the place-value chart as shown. Emphasize that 2 ones 11 tenths names the same number as 3 ones 1 tenth.

ones	tenths
2	11
3	1

Using the Pages

- For the worked example, have the children compare the illustrations of models, the blue on the numerals, and the statements for each step. Point out that lining up the decimal points in the two numerals lines up the whole

Working Together

Follow the steps.

$$\begin{array}{r} 1. \quad 4.8 \\ - 2.3 \\ \hline 2.5 \end{array}$$

Subtract tenths.
Subtract ones.

$$\begin{array}{r} 2. \quad 6.2 \\ - 1.7 \\ \hline 4.5 \end{array}$$

Regroup to show 1 less one and 10 more tenths.
Subtract tenths.
Subtract ones.

Subtract.

$$\begin{array}{r} 3. \quad 5.8 \\ - 4.2 \\ \hline 1.6 \end{array}$$

$$\begin{array}{r} 4. \quad 5.3 \\ - 3.5 \\ \hline 1.8 \end{array}$$

$$\begin{array}{r} 5. \quad 4.5 \\ - 0.8 \\ \hline 3.7 \end{array}$$

Exercises

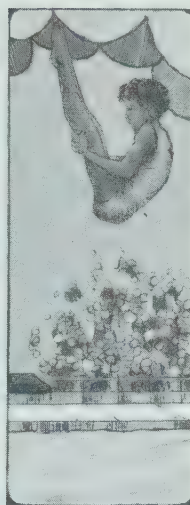
Subtract.

$$\begin{array}{l} 1. \quad 6.7 - 5.3 \quad 1.4 \\ 2. \quad 2.9 - 0.2 \quad 2.7 \\ 3. \quad 4.4 - 2.8 \quad 1.6 \\ 4. \quad 6.0 - 2.7 \quad 3.3 \\ 5. \quad 5.2 \\ - 4.1 \\ \hline 1.1 \\ 6. \quad 4.7 \\ - 0.2 \\ \hline 4.5 \\ 7. \quad 7.4 \\ - 4.1 \\ \hline 3.3 \\ 8. \quad 7.3 \\ - 3.6 \\ \hline 3.7 \\ 9. \quad 7.0 \\ - 2.5 \\ \hline 4.5 \\ 10. \quad 8.6 \\ - 4.1 \\ \hline 4.5 \\ 11. \quad 9.5 \\ - 7.6 \\ \hline 1.9 \\ 12. \quad 0.8 \\ - 0.5 \\ \hline 0.3 \\ 13. \quad 6.1 \\ - 3.3 \\ \hline 2.8 \\ 14. \quad 4.2 \\ - 1.9 \\ \hline 2.3 \\ 15. \quad 9.1 \\ - 1.7 \\ \hline 7.4 \\ 16. \quad 7.7 \\ - 6.5 \\ \hline 1.2 \end{array}$$

Greta and Stacy used tenths to score their dives in practice.

17. On her first dive, Greta scored 9.0. Stacy scored 7.5. How many more points did Greta score? **1.5**

*18. The picture shows the scores on each of four dives. Who was ahead after four dives? By how much? **0.5 Greta**



Greta
9.0
6.5
8.5
7.0

Stacy
7.5
8.5
5.5
9.0

255

RELATED ACTIVITIES

• Charts similar to the one shown would provide more practice. (Copies of page T367 may be used.)

-	2.5
3.4	0.9
4.9	
5.2	

• Adapt the game "Product Search" on page T350 for subtraction of decimals with regrouping. Mark one die with 1.6, 1.7, 1.8, 1.9, 2.7, 2.8 and the other die with 3.1, 4.2, 5.3, 6.4, 7.5, 8.6. Make a game board as shown. The children subtract the lesser number from the greater number.

-	1.6	1.7	1.8	1.9	2.7	2.8
3.1						
4.2						
5.3						
6.4						
7.5						
8.6						

• Children having difficulty may benefit from completing subtraction exercises on place-value charts or on lined paper turned sideways.

• Copies of page T363 may be used as described in the Overview for Unit 7 to represent decimals. The diagrams for decimals may be used to illustrate a subtraction without regrouping or with regrouping 1 one as 10 tenths. The charts may be displayed for reference.

numbers and the tenths. Establish that since 5 tenths cannot be subtracted from 2 tenths, it is necessary to regroup one of the 3 ones as 10 tenths. Emphasize that 2 ones 12 tenths names the same number as 3 ones 2 tenths. Discuss how the models and the numerals show subtracting the tenths. Then discuss how the models and the numerals show subtracting the ones. Read the statement at the bottom of page 254. Demonstrate subtraction with whole numbers using the exercise $32 - 15$. Ask the children to compare subtracting decimals with subtracting whole numbers. Lead them to realize that subtraction with decimals requires the same process as subtraction with whole numbers.

Working Together: Use the exercises to lead the children to understand that regrouping is used only when necessary.

Exercises: Have the children line up the ones and tenths in vertical form for Ex. 1-4. Reinforce that regrouping occurs only when necessary. Review that 0 is written in the difference to show 0 ones, as in Ex. 12.

Discuss the illustrations and diving scores on page 255. The children may need to know that each diver's scores are

recorded to show the number of points received out of ten for each dive. Point out that Stacy's score of 7.5 was awarded for a performance that was judged to be better than a 7 (7.0) but not as good as an 8 (8.0). Ex. 18 is starred because more than one step is required.

Assessment

Subtract.

$$\begin{array}{l} 1. \quad 5.7 - 3.1 \quad 2.6 \\ 2. \quad 6.4 - 0.8 \quad 5.6 \\ 3. \quad 0.9 \\ - 0.4 \\ \hline 0.5 \\ 4. \quad 3.0 \\ - 2.9 \\ \hline 0.1 \end{array}$$

OBJECTIVE

Demonstrate competence in adding and subtracting decimals with regrouping; solve related word problems

Vocabulary

uneven bars, vault, balance beam, floor exercises

Practice

Tracy and Peg were in four events in the gymnastics meet. A perfect score in one event is 10.0.



Uneven Bars

Tracy	7.5
Peg	8.5



Vault

Tracy	8.0
Peg	6.5

- Who had the higher score on the uneven bars? How much higher was it? **1.0**
- Who had the lower score for the vault? How much lower was it? **1.5**
- What was Tracy's total score after the first two events? **15.5**
- What was Peg's total score after the first two events? **15.0**
- Who had the higher total score after two events? **Tracy**
How much higher was it? **0.5**
- In which event did Tracy earn her best score? How much less than a perfect 10.0 was it? **1.5**
- In which event did Peg earn her best score? How much less than a perfect 10.0 was it? **0.5**
- Who had the lowest score in any event? How much less than a perfect 10.0 was the score? **3.5**

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LESSON ACTIVITY

Using the Pages

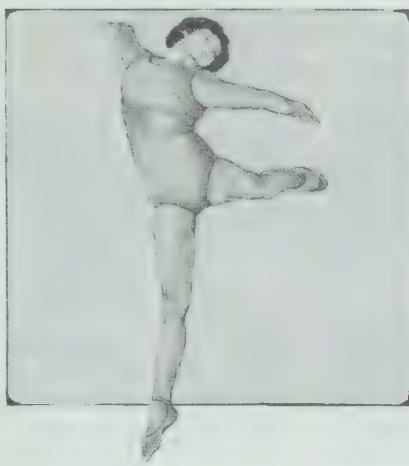
- Read the statement at the top of page 256. Use the pictures to motivate a discussion about gymnastics. Relate each picture to the name of the event underneath the picture and to the girls' scores. For each event, ask who had the higher (lower) score.
- Ex. 1-13 involve determining whether addition or subtraction is necessary to solve the problem. Some of the problems ask one question. Others ask two questions with the second depending on the answer to the first. Some of the problems require repeating work completed for previous problems or referring to a previous problem for the information.

Have a few children answer Ex. 1 at the board. Discuss any difficulties that arise.

Have the children show the addition or subtraction for Ex. 1-13. This may help you determine the reason for any errors. Remind the children to answer each question. Some children will enjoy the challenge in Ex. 13.

Have the children line up Ex. 14-19 in vertical form. Remind the children to note the signs in Ex. 14-3. Reinforce the need for the decimal point.

Determine whether errors are due to regrouping when necessary, not regrouping when necessary, regrouping incorrectly, forgetting addition or subtraction facts, confusing addition and subtraction, or not understanding the word problem. Provide review where needed.



Balance Beam

Floor Exercises

Tracy	7.5
Peg	9.5

Tracy	8.5
Peg	7.5

Tracy's: 23.0 Peg's: 24.5

9. What were Tracy's and Peg's total scores after three events?

10. Who was ahead after three events? By how much? **1.5**

11. What were Tracy's and Peg's total scores after four events?
Tracy's: 31.5 Peg's: 32.0

12. Who had the higher total score after four events? **Peg**
How much higher was it? **0.5**

*13. Thelma's scores for four events were all the same. Her total was the same as Peg's total. How much did Thelma score in each event? **8.0**

Add or subtract.

14. $4.4 - 2.1$ **2.3**

16. $0.4 + 2.9$ **3.3**

18. $7.8 - 1.4$ **6.4**

20.
$$\begin{array}{r} 5.2 \\ - 4.3 \\ \hline 0.9 \end{array}$$

23.
$$\begin{array}{r} 5.2 \\ + 4.4 \\ \hline 9.6 \end{array}$$

26.
$$\begin{array}{r} 3.2 \\ - 2.4 \\ \hline 0.8 \end{array}$$

29.
$$\begin{array}{r} 1.9 \\ + 2.5 \\ \hline 4.4 \end{array}$$

21.
$$\begin{array}{r} 5.7 \\ + 3.4 \\ \hline 9.1 \end{array}$$

24.
$$\begin{array}{r} 3.5 \\ - 0.8 \\ \hline 4.3 \end{array}$$

27.
$$\begin{array}{r} 4.1 \\ + 3.9 \\ \hline 8.0 \end{array}$$

30.
$$\begin{array}{r} 7.1 \\ - 3.9 \\ \hline 3.2 \end{array}$$

15. $2.3 + 5.4$ **7.7**

17. $1.2 - 0.6$ **0.6**

19. $2.8 + 1.7$ **4.5**

22.
$$\begin{array}{r} 1.1 \\ - 0.5 \\ \hline 0.6 \end{array}$$

25.
$$\begin{array}{r} 6.0 \\ - 3.4 \\ \hline 2.6 \end{array}$$

28.
$$\begin{array}{r} 5.7 \\ - 4.1 \\ \hline 1.6 \end{array}$$

31.
$$\begin{array}{r} 6.6 \\ + 1.7 \\ \hline 8.3 \end{array}$$

RELATED ACTIVITIES

- Adapt the third activity on page T 145 for subtraction of decimals.
- Adapt the game "Total Action" on page T 349 for addition of decimals. Prepare three numeral cards for each of the decimals 0.0, 0.1, 0.2, . . . , 1.4, and one card for 5.0. A set of cards consists of cards with a sum of 2.0.
- Some children may enjoy creating word problems about gymnastics or sports. These may be made into a book. Children could illustrate or solve the problems.
- To provide practice in deciding which of two decimals is greater, prepare numeral cards for various decimals from 0.0 to 9.9 and a card with the symbol $>$. Place the symbol card on a table. A child takes two numeral cards and places one on each side of the symbol card. Then the child states whether the number sentence is true or false. This activity may be used individually or for a small group in which each player has a turn. For each correct answer, a player scores one point. The child with the greatest number of points after six turns each is the winner.

LESSON OUTCOME

Read and write decimal notation from 0.00 to 9.99

Materials

a model for 0.15 made from a copy on page T364 as described in the Overview for Unit 14

Vocabulary

hundredths

Prerequisite Skills

Read and write decimals from 0.0 to 9.9

Checking Prerequisite Skills

Write the decimals.

- one and four-tenths **1.4**
- six-tenths **0.6**

Write the words.

- 7.7**
- 0.9** **nine-tenths**
seven and seven-tenths

Background

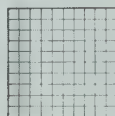
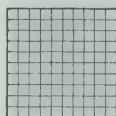
In Unit 7, one-tenth is introduced as one of 10 equal parts of a whole. On page 258, one-hundredth is introduced as one of 100 equal parts of a whole. Just as a whole can be divided into ten equal parts, it can be divided into one hundred equal parts. Each of the one hundred equal parts is called a *hundredth*.

Using Decimals to Show Wholes and Hundredths



1 whole and
2 of 10 equal parts
of another whole
is written

$$1\frac{2}{10} \text{ or } 1.2$$

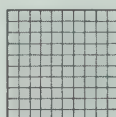


1 whole and
20 of 100 equal parts
of another whole
is written

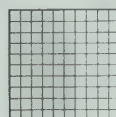
$$1\frac{20}{100} \text{ or } 1.20$$

one and twenty-hundredths

1 whole



57 of 100
equal parts

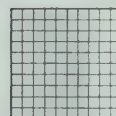


Write

$$1\frac{57}{100} \text{ or } 1.57$$

0 wholes

68 of 100
equal parts

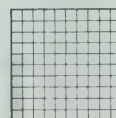


Write

$$\frac{68}{100} \text{ or } 0.68$$

0 wholes

6 of 100
equal parts



Write

$$\frac{6}{100} \text{ or } 0.06$$

LESSON ACTIVITY

Before Using the Pages

- Display a model for 0.15 (see *Materials*). Ask:
“Are the parts equal?”
“How many equal parts are shown?” (Have a child point to each square as the others count aloud. The children will likely count by tens once they realize that each row has ten squares.)
“How many parts are colored?” (Have a child point to each colored square as the others count aloud.)
“How could you express this number?” (The children may answer in various ways; for example, “15 blue parts of 100 equal parts of a whole” or “fifteen-hundredths”.)

Using the Pages

- Direct the children’s attention to the diagram for 1.2. Ask for the number of wholes. Then ask for the number of tenths. Read the information explaining the two ways of express-

ing this. Review that the fraction $1\frac{2}{10}$ and the decimal 1.2 each name the same amount.

Then direct the children’s attention to the diagram for 1.20. Ask for the number of wholes. Then direct the children’s attention to the part of the diagram showing hundredths. Ask:

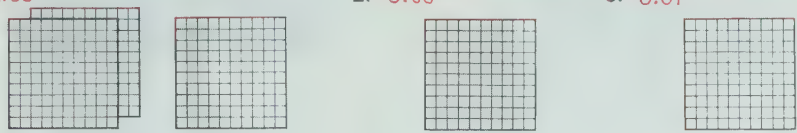
- “Are the parts equal?”
- “How many parts are shown?”
- “How many parts are blue?”

Read the information explaining how this can be shown. Introduce the word *hundredths*. Tell the children that a shape must be divided into one hundred equal parts to show hundredths. Compare the fraction, the decimal, and the word name. Direct the children’s attention to how the whole is represented in each and how the 20 of 100 equal parts are represented in each. Emphasize that each of these three ways names the same amount. Some children may realize that the amount represented by 1.2 is the same as the amount represented by 1.20.

Working Together

How many wholes?
How many hundredths?

Give the decimal that shows how much is shaded.
1. 2 wholes 33 hundredths 2. 0 wholes 86 hundredths 3. 0 wholes 1 hundredth



Write the decimals.

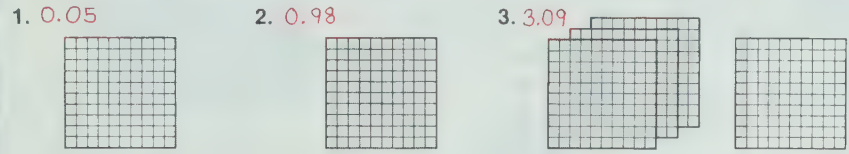
- 4. three and seventy-five hundredths 3.75
- 5. one and four-hundredths 1.04
- 6. thirty-hundredths 0.30
- 7. seven-hundredths 0.07

Write the words.

- 8. 2.59
- 9. 0.75
- 10. 3.06
- 11. 0.04
- 12. two and fifty-nine hundredths
- 13. seventy-five hundredths
- 14. three and six-hundredths
- 15. four-hundredths

Exercises

Write the decimal that shows how much is shaded.



Write the decimals.

- 4. four and eleven-hundredths 4.11
- 5. thirty-three hundredths 0.33
- 6. two and five-hundredths 2.05
- 7. two-hundredths 0.02
- 8. two and forty-hundredths 2.40
- 9. three and nineteen-hundredths 3.19
- 10. four and one-hundredth 4.01
- 11. twenty-hundredths 0.20

Write the words.

- 12. 5.75
- 13. 3.60
- 14. 0.03
- 15. 2.22
- 16. 4.04
- 17. 0.18
- 18. five and seventy-five hundredths
- 19. three-hundredths
- 20. four and four-hundredths
- 21. three and sixty-hundredths
- 22. two and twenty-two hundredths
- 23. eighteen-hundredths

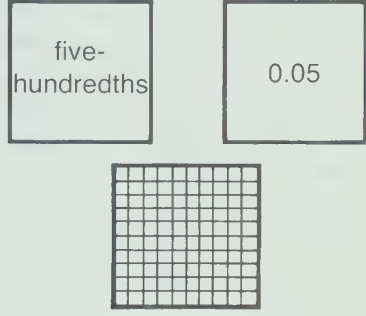
Work through the other three examples with similar questions. Emphasize that there must be two digits to the right of the decimal point to show hundredths. For the fifth example, review that the zero to the left of the decimal point indicates that there are zero wholes. To understand the meaning of the zero to the right of the decimal point, develop the following pattern on the board.

19 hundredths	0.19
18 hundredths	0.18
17 hundredths	0.17
.	.
.	.
.	.
10 hundredths	0.10
9 hundredths	0.09
8 hundredths	0.08

This pattern will help to illustrate that there must be two digits to the right of the decimal point for hundredths.

RELATED ACTIVITIES

- Children may find examples of hundredths for the decimal display. Also, they may be able to discuss examples they have found previously.
- Have children prepare sets of cards naming and showing hundredths. For each number there are three cards: a word name card (use page T 362), a numeral card (use page T 362), and a picture card (use page T 364, coloring the appropriate number of squares). These three types of cards may be used for games in Unit 14.



- Any two of these three types of cards may be used for the game "Concentration" or for the game "Snap", each described on page T 349.
- Children may represent decimals greater than one, showing hundredths as described in the Overview for Unit 14.
- Read a list of decimals. Have the children write the numerals and/or the word names.
- Have children read decimals from a list.

Working Together: The order of the questions for Ex. 1-3 asks the children to consider the number of wholes first and then the number of hundredths. Many of these exercises provide the opportunity to review and check the children's understanding of the use of zero in a numeral.

Exercises: After the children have completed the exercises, you may wish to have them read the decimals aloud.

Assessment

Write the decimals.

- 1. one and ten-hundredths 1.10
- 2. seven-hundredths 0.07

Write the words.

- 3. 0.90
- 4. 6.02
- six and two-hundredths
- ninety-hundredths

LESSON OUTCOME

Identify cents as hundredths of a dollar; express amounts of money in cents and in dollars

Prerequisite Skills


Read and write numerals for amounts of money

Checking Prerequisite Skills


Copy and complete the table.

	Dollars	Dimes	Pennies	Amount
1.	1	5	7	? 1 .57
2.	1	0	2	? 1 .02
3.	0	0	8	? 0 .08
4.	? 1	? 6	? 0	\$1.60
5.	? 0	? 0	? 3	\$0.03

Decimals and Money




are worth



\$1.00
one dollar


100 cents



1 cent
(1¢)


is worth one-hundredth of a dollar or

\$0.01



5 cents
(5¢)


is worth



five-hundredths of a dollar


or

\$0.05



10 cents
(10¢)


is worth



ten-hundredths of a dollar


or

\$0.10



25 cents
(25¢)

is worth



twenty-five hundredths of a dollar

or

\$0.25

LESSON ACTIVITY

Using the Pages

- Read the three ways shown at the top of page 260 to represent one dollar. Use the stacks of pennies to develop that 100 cents is the same value as one dollar, and therefore, one cent is one-hundredth of a dollar.
Read the information about one cent. Have the children compare the two numerals representing one cent — 1¢ and \$0.01. Develop the fact that when the ¢ symbol is used, the numeral to its left indicates whole cents and there is no decimal point. However, when the \$ symbol is used, a decimal point is needed to indicate cents because cents are hundredths of a dollar. Have a child write the decimal for one-hundredth on the board (0.01). Compare the decimal for one-hundredth and the way to use the symbol \$ for writing 1 cent (\$0.01).
Discuss each of the remaining examples in a similar way. Emphasize the reason for each zero shown.

Working Together: Children may find it helpful to count the bills and coins beginning with the largest.

Children having difficulty may benefit from the following.

Place-value approach: 1 cent is 1 hundredth of a dollar. 135¢ is 135 hundredths of a dollar, which can be regrouped as 1 dollar and 35 hundredths of a dollar, or 1.35 dollars, which is written \$1.35.

Part-of-a-whole approach: 135¢ is 1 dollar and 35 cents, which is the same as 1 dollar and 35 hundredths of a dollar or 1.35 dollars, which is written \$1.35.

Review how the \$ symbol is used when the amount is written as a decimal, and, therefore, has a decimal point between the dollars and the cents. Two digits are needed to the right of the decimal point because cents are hundredths of a dollar. Point out that amounts less than one dollar may be written two ways, either with the ¢ symbol or the \$ symbol, but that amounts greater than 99¢ are only shown with the \$ symbol.

Working Together

Show how many cents (¢) each group is worth.
Then show each amount another way
using the dollar sign (\$) and a decimal.

1. 44¢
\$0.44

2. 135¢
\$1.35

3. 141¢
\$1.41

4. 103¢
\$1.03

Exercises

Show how many cents (¢) each group is worth.
Then show each amount another way
using the dollar sign (\$) and a decimal.

1. 136¢, \$1.36

2. 103¢
\$1.03

Copy and complete the table.

	Dollars	Quarters	Dimes	Nickels	Pennies	Value (¢)	Value (\$)
3.	1	1	1			135¢	\$1.35
4.		1	1	1		? 40¢	? \$0.40
5.	1				5	? 105¢	? \$1.05
6.		4				? 100¢	? \$1.00
7.			3	4	5	? 55¢	? \$0.55
8.		3	3	3	3	? 123¢	? \$1.23
*9.	?	?	?	?	?	72¢	? \$0.72
*10.	?	?	?	?	?	? 118¢	\$1.18

Ex. 9-10 Answers will vary for
Dollars, Quarters, Dimes, Nickels, and Pennies.

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RELATED ACTIVITIES

• Cards similar to the following may be used for the game “Snap” as described on page T 349.

\$0.65

sixty-five hundredths of a dollar

• Children may select bills and coins to represent the amounts of money named in Ex. 3-10 on page 261. (Copies of pages T 351 and 352 may be used.)

• Have the children complete the chart for Ex. 9 and 10 on page 261 and for other amounts of money using the least number of coins.

• You may wish to play the game “Show Me”. State, “Show me 25 hundredths of a dollar.” The children select the appropriate coin(s). (Copies of page T 351 may be used.) Children may enjoy comparing different correct responses.

• The above activity could be adapted for a chart similar to the one on page 261. Instead of selecting the coins, the children record the number of each coin required on the chart.

• Either of the two above activities could be reversed by showing or naming a selection of coins and having the children tell the number of hundredths of a dollar that are represented.

Exercises: To explain the table for Ex. 3-10, have the children complete Ex. 3 together.

Tell the children that there are different ways of answering Ex. 9 and 10 and that it is not necessary to show a number in each column. For example, for Ex. 9, a child could show 6 dimes, 2 nickels, and 2 pennies for 72¢. Children may enjoy sharing their answers.

Assessment

Copy and complete the table.

Dollars	Quarters	Dimes	Nickels	Pennies	Value (¢)	Value (\$)
1	1		2	1	?	?
	3	5	3	4	?	?
	3	2	1		?	?
1			6		?	?

136¢ \$1.36
144¢ \$1.44
100¢ \$1.00
130¢ \$1.30

LESSON OUTCOME

Express metres as centimetres and centimetres as metres using decimals

Materials

measuring tapes, metre sticks marked in centimetres (for Ex. 14-17 and for *Before Using the Pages*), objects to measure

Vocabulary

obstacle

Prerequisite Skills

Write decimals to express hundredths

Checking Prerequisite Skills

Write the decimals.

- 2 and 25 hundredths **2.25**
- 1 and 4 hundredths **1.04**
- 50 hundredths **0.50**
- 32 hundredths **0.32**

Background

Expressing centimetres as metres and metres as centimetres can be approached in terms of place value or in terms of part of a whole. For example, 1 cm equals 1 hundredth of a metre, 164 cm equals 164 hundredths of a metre, or 1 and 64 hundredths metres, or 1.64 m. The part-of-a-whole method considers 164 cm as 1 m and 64 cm, or 1 m and 64 of 100 equal parts of a whole metre, or 1.64 m.

Metres, Centimetres, and Decimals

John is running the obstacle course. This obstacle is 1 m and 15 cm high. A decimal can show this height in metres.



1 cm is 1 of 100 equal parts of a metre.
15 cm is 15 of 100 equal parts of a metre.

1 m and 15 cm can be written **1.15 m** 1 and 15-hundredths metres

The obstacle is 1.15 m high.

Working Together

Complete these tables.

1.	123 cm	1 m and 23 cm	
2.	105 cm	1 m and 5 ? cm	
3.	87 cm	0 m and 87 ? cm	
4.		2 m and 31 cm	2.31 m
5.		1 m and 7 cm	1.07 ? m
6.		0 m and 25 cm	0.25 ? m
7.	312 cm		3.12 m
8.	40 cm		0.40 ? m
9.	1 cm		0.01 ? m

10.	1.32 m	1 m and 32 cm	
11.	2.80 m	2 m and 80 ? cm	
12.	0.04 m	0 m and 4 ? cm	
13.		3 m and 21 cm	3.21 cm
14.		1 m and 8 cm	1.08 ? cm
15.		0 m and 75 cm	0.75 ? cm
16.	2.13 m		2.13 cm
17.	0.94 m		0.94 ? cm
18.	1.01 m		1.01 ? cm

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LESSON ACTIVITY

Before Using the Pages

- To review measuring with metres and with centimetres, leave the measuring equipment suggested in *Materials* on display for a few days before the lesson. Guide the review with instructions such as the following:

“Estimate the height of a table in centimetres. Measure to check.”

“Estimate the length of the room in metres. Measure to check.”

Consider the children’s results; for example, if the length of the room is greater than 7 m but less than 8 m, discuss the need for a smaller unit to obtain a more precise measurement of the length.

Have a child measure an object longer than one metre in centimetres only. Record the measurement on the board in a chart similar to the one shown. Have another child measure the object in metres and centimetres. Record this on the chart. Have a third child measure the object in whole

metres and hundredths of a metre. Record this on the chart using decimals. Repeat this with a few examples. Discuss the relationship among these measurements.

136 cm 1 m and 36 cm 1.36 m

Use a ruler to develop the following relationships:
1 cm = 0.01 m; 36 cm = 0.36 m; 136 cm = 1.36 m.

Reverse the above procedure by having a child measure an object first in whole metres and hundredths of a metre. Discuss the relationship among these measurements.

1.55 m 1 m and 55 cm 155 cm

Use a ruler to develop the following relationships:
1 m = 100 cm; 0.55 m = 55 cm; and 1.55 m = 155 cm.

Using the Pages

- Read the information at the top of page 262. Relate the term *obstacle course* to the picture. Have the children point to the obstacle that is 1 m and 15 cm high.
- The two approaches for expressing the height 1 m and 15 cm are shown below the picture.

RELATED ACTIVITIES

• Leave the measuring center described in *Lesson Activity* set up for a few days after the lesson. After some free exploration, guide the children's measuring activities by having them measure given objects and/or objects of their choice in metres or in centimetres. Then have them complete a chart similar to the one for Ex. 4-13 on page 263.

• Children may write exercises similar to those in Ex. 14-17 for other children to obtain the measurements.

• For reinforcement, prepare a work sheet similar to the following. Each row shows two equal lengths and one length that is different. Tell the children to ring the one in each row that does not name the same length as the other two.

140 cm	(1 m and 4 cm)	1.40 m
123 cm	1 m and 23 cm	1.32 m
120 cm	1 m and 2 cm	1.02 cm

• Adapt the game "Check Off" on page T350. The list of sixteen numbers would consist of lengths such as 1.43 m. The caller would express the lengths on the list in terms of metres (1.43 m), centimetres (143 cm), or metres and centimetres (1 m and 43 cm).



18. Write the height of the high-jump bar in metres. *about 1.8m*
19. Greg Joy of Canada won an Olympic medal with a high jump of 2 m and 23 cm. Write this height in metres. *2.23m*

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Exercises

Copy and continue each table.

1.	100 cm	1 m and 0 cm	1.00 m
	200 cm	2 m and 0 cm	2.00 m

Continue to 600 cm.

2.	170 cm	1 m and 70 cm	1.70 m
	180 cm	1 m and 80 cm	1.80 m

Continue to 220 cm.

3.	297 cm	2 m and 97 cm	2.97 m
	298 cm	2 m and 98 cm	2.98 m

Continue to 302 cm.

Copy and complete this table.

4.	165 cm	1 m and 65 cm	1.65 m
5.	318 cm	? m and 18 cm	3.18 m
6.	106 cm	? m and 6 cm	1.06 m
7.	24 cm	? m and 24 cm	0.24 m
8.	102 cm	1 m and 2 cm	1.02 m
9.	377 cm	3 m and 77 cm	3.77 m
10.	15 cm	0 m and 15 cm	0.15 m
11.	130 cm	? m and 30 cm	1.30 m
12.	109 cm	? m and 9 cm	1.09 m
13.	77 cm	? m and 77 cm	0.77 m

Measure and write each length in centimetres. Then use a decimal and write each length in metres.
Ex. 14-17 Answers will vary.

- your height
- how high you can reach
- how far apart you can spread your arms
- how far you can step

2.	190 cm	1 m and 90 cm	1.90 m
	200 cm	2 m and 0 cm	2.00 m
	210 cm	2 m and 10 cm	2.10 m
	220 cm	2 m and 20 cm	2.20 m

3.	299 cm	2 m and 99 cm	2.99 m
	300 cm	3 m and 0 cm	3.00 m
	301 cm	3 m and 1 cm	3.01 m
	302 cm	3 m and 2 cm	3.02 m

Part-of-a-whole approach: 1 m and 15 cm is 1 m and 15 of 100 equal parts of a whole metre, or 1.15 m.

Place-value approach: 1 m and 15 cm is 115 hundredths metres, or 1 and 15 hundredths metres, or 1.15 m.

Discuss metres and centimetres by reviewing the two relationships: 1 cm = 0.01 m and 1 m = 100 cm.

Working Together: Children having difficulty may benefit from considering the measurements in terms of place value or in terms of part of a whole.

Discuss the following stages for completing the tables.

- Ex. 1-3 are essentially a process of replacing 100 cm by 1 m.
- Ex. 4-6 show that the centimetres are parts of another metre.
- Ex. 7-9 require the children to write the final form without considering an intermediate step.
- Ex. 10-12 require the decimal form to be expressed as metres and centimetres.
- Ex. 13-15 require metres and centimetres to be expressed as centimetres.

6. Ex. 16-18 require the decimal form to be expressed as centimetres only.

Provide more examples of any type that the children find difficult.

Exercises: Children may need assistance with the instructions for each table.

Provide the children with measuring tapes or metre sticks and have them work in pairs for Ex. 14-17.

Have them refer to the picture on page 263 for Ex. 18.

Assessment

Copy and complete this table.

1.	143 cm	1 ? m and 43 cm	1.43 ? m
2.	102 cm	1 ? m and 2 cm	1.02 ? m
3.	140 cm	1 m and 40 cm	1.40 ? m
4.	3 cm	0 m and 3 cm	0.03 ? m
5.	23 cm	0 ? m and 23 cm	0.23 m
6.	105 cm	1 ? m and 5 cm	1.05 m

OBJECTIVE

Demonstrate an understanding of the concepts and skills presented in this unit

RELATED ACTIVITIES

- To reinforce hundreds, the three types of cards prepared for the second activity on page T 285 could be used for the game "Match Up" described on page T 349. (A set of matching cards consists of a word name card, a decimal card, and a picture card illustrating a decimal.)
- The above activity could be adapted for reviewing tenths by using the cards prepared for the second activity on page T 135.
- For reinforcement with writing lengths in metres and centimetres, prepare a work sheet that names pairs of equal lengths (162 cm, 1.62 m) and pairs of unequal lengths (150 cm, 1.05 m). Tell the children to ring the pairs that show equal lengths.
- For more practice in adding and subtracting decimals, have children add across and subtract down for squares similar to the following. The lower right square provides a check.

			+	
5.7	2.3			
4.8	0.9			

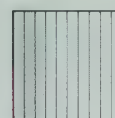
Checking Up

Write a decimal to show how much is shaded. Use tenths.

1. 2.6

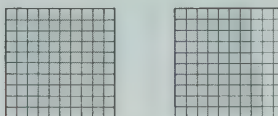


2. 0.3

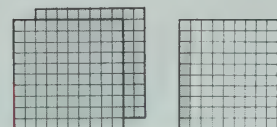


Write a decimal to show how much is shaded. Use hundredths.

3. 1.75



4. 2.09



Write the decimals.

5. three and four-tenths 3.4

6. three-hundredths 0.03

Write the words.

7. 4.5

8. 0.7

9. 2.57

10. 1.02

7. four and five-tenths

8. seven-tenths

9. two and fifty-seven hundredths

10. one and two-hundredths

Show how many cents (¢) each group of coins is worth. Then show each amount another way using the dollar sign (\$) and a decimal.

11. 85¢ \$0.85



12. 107¢ \$1.07



Use a decimal and write each length in metres.

13. 2 m and 36 cm 2.36 m

14. 1 m and 4 cm 1.04 m

15. 49 cm 0.49 m

16. 325 cm 3.25 m

Write each length in centimetres.

17. 1 m and 67 cm 167 cm

18. 2 m and 5 cm 205 cm

19. 2.35 m 235 cm

20. 0.89 m 89 cm

Add.

Subtract.

$$\begin{array}{r} 21. \quad 2.4 \\ + 3.2 \\ \hline 5.6 \end{array}$$

$$\begin{array}{r} 22. \quad 1.6 \\ + 2.7 \\ \hline 4.3 \end{array}$$

$$\begin{array}{r} 23. \quad 3.8 \\ + 1.6 \\ \hline 5.4 \end{array}$$

$$\begin{array}{r} 24. \quad 4.7 \\ - 2.3 \\ \hline 2.4 \end{array}$$

$$\begin{array}{r} 25. \quad 7.1 \\ - 1.6 \\ \hline 5.5 \end{array}$$

$$\begin{array}{r} 26. \quad 6.6 \\ - 3.7 \\ \hline 2.9 \end{array}$$

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Comments

If children confuse decimals for tenths and for hundredths, use models to compare tenths (as described in the Overview for Unit 7) and models for hundredths (as described in the Overview for Unit 14).

If children have difficulty with the zero in the tenths' place in Ex. 4, 6, and 10, use models to review the concept of hundredths.

For Ex. 11 and 12, remind the children that each amount of money can be recorded using either the symbol ¢ or the symbol \$, but amounts of money greater than 99¢ are usually written with the symbol \$.

For Ex. 13-20, review that the exercises in the book and the answers each name the same length. If children have difficulty understanding this, draw a line segment on the board or cut a string the appropriate length. Measure the length according to the exercise and according to the answer.

Remind the children that the decimal point must be written for Ex. 21-26 to separate the ones and the tenths.

Skills	Exercises	Related Pages
Write decimals for diagrams, tenths	1, 2	T 278-T 279
Write decimals for diagrams, hundredths	3, 4	T 284-T 285
Write decimals for words, tenths	5	T 278-T 279
Write decimals for words, hundredths	6	T 284-T 285
Write word names for decimals, tenths	7, 8	T 278-T 279
Write word names for decimals, hundredths	9, 10	T 284-T 285
Express amounts of money in cents and in dollars	11, 12	T 286-T 287
Express metres and centimetres as metres	13-16	T 288-T 289
Express metres and centimetres as centimetres	17-20	T 288-T 289
Add decimals, tenths	21-23	T 144-T 145
Subtract decimals, tenths	24-26	T 280-T 281

OBJECTIVE

Demonstrate competence in addition and subtraction skills; recall basic multiplication and division facts

RELATED ACTIVITIES

• Adapt the game "Check Off" on page T 350 for multiplication. The list of sixteen numbers is a list of products for basic multiplication facts presented in Unit 8. The caller states the factors for the products on the list.

• Pairs of cards similar to the following may be used for the game "Snap" described on page T 349.

$$12 \div 3$$

$$4$$

• Have children complete number sentences similar to the following by supplying the operation signs (+, -, ×, ÷) to make a true statement.

$$2 \boxed{+} 5 = 21 \boxed{-} 3$$

$$6 \boxed{\times} 4 = 12 \boxed{\times} 2$$

$$5 \boxed{\times} 1 = 5 \boxed{+} 0 \text{ (or -)}$$

$$7 \boxed{\times} 3 = 24 \boxed{-} 3$$

$$11 \boxed{-} 2 = 45 \boxed{-} 5$$

$$6 \boxed{-} 5 = 5 \boxed{-} 5$$

$$8 \boxed{\times} 2 = 4 \boxed{\times} 4$$

$$16 \boxed{-} 4 = 4 \boxed{+} 0 \text{ (or -)}$$

$$1 \boxed{+} 7 = 4 \boxed{\times} 2$$

$$36 \boxed{-} 4 = 27 \boxed{-} 3$$

$$47 \boxed{+} 2 = 51 \boxed{-} 2$$

$$36 \boxed{-} 6 = 5 \boxed{\times} 6$$

Add.

1. $\begin{array}{r} 452 \\ + 426 \\ \hline 878 \end{array}$	2. $\begin{array}{r} 305 \\ + 43 \\ \hline 348 \end{array}$	3. $\begin{array}{r} 246 \\ + 430 \\ \hline 676 \end{array}$	4. $\begin{array}{r} \$2.13 \\ + 0.53 \\ \hline \$2.66 \end{array}$	5. $\begin{array}{r} \$4.31 \\ + 1.47 \\ \hline \$5.78 \end{array}$
6. $\begin{array}{r} 172 \\ + 35 \\ \hline 207 \end{array}$	7. $\begin{array}{r} 226 \\ + 328 \\ \hline 554 \end{array}$	8. $\begin{array}{r} 491 \\ + 256 \\ \hline 747 \end{array}$	9. $\begin{array}{r} \$6.17 \\ + 2.48 \\ \hline \$8.65 \end{array}$	10. $\begin{array}{r} \$8.53 \\ + 2.12 \\ \hline \$10.65 \end{array}$
11. $\begin{array}{r} 528 \\ + 617 \\ \hline 1145 \end{array}$	12. $\begin{array}{r} 940 \\ + 97 \\ \hline 1037 \end{array}$	13. $\begin{array}{r} 236 \\ + 575 \\ \hline 811 \end{array}$	14. $\begin{array}{r} \$5.81 \\ + 7.93 \\ \hline \$13.74 \end{array}$	15. $\begin{array}{r} \$8.42 \\ + 4.67 \\ \hline \$13.09 \end{array}$
16. $\begin{array}{r} 320 \\ 152 \\ + 114 \\ \hline 586 \end{array}$	17. $\begin{array}{r} 375 \\ 63 \\ + 321 \\ \hline 759 \end{array}$	18. $\begin{array}{r} 28 \\ 118 \\ + 37 \\ \hline 183 \end{array}$	19. $\begin{array}{r} \$8.15 \\ 3.47 \\ + 7.36 \\ \hline \$18.98 \end{array}$	20. $\begin{array}{r} \$6.61 \\ 4.90 \\ + 7.56 \\ \hline \$19.07 \end{array}$

Subtract.

21. $\begin{array}{r} 367 \\ - 32 \\ \hline 335 \end{array}$	22. $\begin{array}{r} 397 \\ - 236 \\ \hline 161 \end{array}$	23. $\begin{array}{r} 856 \\ - 424 \\ \hline 432 \end{array}$	24. $\begin{array}{r} \$5.77 \\ - 0.13 \\ \hline \$5.64 \end{array}$	25. $\begin{array}{r} \$9.56 \\ - 2.35 \\ \hline \$7.21 \end{array}$
26. $\begin{array}{r} 792 \\ - 477 \\ \hline 315 \end{array}$	27. $\begin{array}{r} 133 \\ - 51 \\ \hline 82 \end{array}$	28. $\begin{array}{r} 309 \\ - 161 \\ \hline 148 \end{array}$	29. $\begin{array}{r} \$6.94 \\ - 2.57 \\ \hline \$4.37 \end{array}$	30. $\begin{array}{r} \$1.28 \\ - 0.36 \\ \hline \$0.92 \end{array}$
31. $\begin{array}{r} 1253 \\ - 426 \\ \hline 827 \end{array}$	32. $\begin{array}{r} 1317 \\ - 975 \\ \hline 342 \end{array}$	33. $\begin{array}{r} 1090 \\ - 225 \\ \hline 865 \end{array}$	34. $\begin{array}{r} \$16.49 \\ - 8.59 \\ \hline \$7.90 \end{array}$	35. $\begin{array}{r} \$13.35 \\ - 6.84 \\ \hline \$6.51 \end{array}$
36. $\begin{array}{r} 1000 \\ - 573 \\ \hline 427 \end{array}$	37. $\begin{array}{r} 1068 \\ - 181 \\ \hline 887 \end{array}$	38. $\begin{array}{r} 1205 \\ - 306 \\ \hline 899 \end{array}$	39. $\begin{array}{r} \$10.00 \\ - 6.41 \\ \hline \$3.59 \end{array}$	40. $\begin{array}{r} \$10.04 \\ - 8.93 \\ \hline \$1.11 \end{array}$

Multiply.

41. $4 \times 2 = 8$	42. $3 \times 3 = 9$	43. $5 \times 1 = 5$	44. $2 \times 3 = 6$	45. $1 \times 4 = 4$
46. $7 \times 2 = 14$	47. $4 \times 4 = 16$	48. $3 \times 4 = 12$	49. $5 \times 3 = 15$	50. $2 \times 5 = 10$
51. $8 \times 4 = 32$	52. $6 \times 5 = 30$	53. $5 \times 4 = 20$	54. $4 \times 5 = 20$	55. $8 \times 3 = 24$

Divide.

56. $6 \div 3 = 2$	57. $8 \div 2 = 4$	58. $3 \div 3 = 1$	59. $4 \div 2 = 2$
60. $16 \div 4 = 4$	61. $15 \div 5 = 3$	62. $10 \div 2 = 5$	63. $18 \div 3 = 6$
64. $21 \div 3 = 7$	65. $20 \div 5 = 4$	66. $28 \div 4 = 7$	67. $27 \div 3 = 9$
68. $30 \div 5 = 6$	69. $36 \div 4 = 9$	70. $45 \div 5 = 9$	71. $32 \div 4 = 8$

KEEPING SHARP

SSON ACTIVITY

ng the Page

the addition section, Ex. 1-5 involve no regrouping. Ex. 6-10 require one regrouping. Ex. 11-15 require two regroupings. Ex. 16-20 involve adding three numbers. Ex. 4, 5, 9, 10, 14, 15, 19, and 20 are addition exercises with amounts of money.

In the subtraction section, Ex. 21-25 involve no regrouping. Ex. 26-30 require one regrouping. Ex. 31-35 require two regroupings. Ex. 31-40 involve subtracting from four-digit numbers. Ex. 36-40 involve regrouping with zeros as described on pages 94-95 and 246-247. Ex. 24, 25, 29, 30, 34, 35, 39, and 40 are subtraction exercises with amounts of money. Ex. 41-55 review basic multiplication facts. Ex. 56-71 review basic division facts.

- For the addition and for the subtraction sections, review facts or skills that are causing difficulty.

For the multiplication and the division sections, remind the children to use objects, pictures, arrays, number lines, repeated addition or repeated subtraction if, but only if, they do not remember the answers.

OBJECTIVE

Demonstrate competence in addition and subtraction skills; recall basic multiplication and division facts; solve related word problems

Checking Skills

Add.

1. 431 + 46 <u>477</u>	2. 543 + 246 <u>789</u>
3. 647 + 327 <u>974</u>	4. 428 + 538 <u>966</u>
5. 242 + 62 <u>304</u>	6. 386 + 142 <u>528</u>
7. 276 + 194 <u>470</u>	8. 345 + 58 <u>403</u>
9. 512 + 544 <u>1056</u>	10. 621 + 852 <u>1473</u>
11. 911 + 337 <u>1248</u>	12. 735 + 653 <u>1388</u>
13. 915 + 657 <u>1572</u>	14. 863 + 252 <u>1115</u>
15. 947 + 81 <u>1028</u>	16. 753 + 917 <u>1670</u>
17. 805 467 + 25 <u>1297</u>	18. 371 94 + 923 <u>1388</u>
19. \$2.48 + 8.35 <u>\$10.83</u>	20. \$3.63 + 9.63 <u>\$13.26</u>
21. \$4.24 2.60 + 3.53 <u>\$10.37</u>	22. \$6.28 7.38 + 1.18 <u>\$14.84</u>

Subtract.

1. 565 - 110 <u>455</u>	2. 258 - 35 <u>223</u>
3. 781 - 46 <u>735</u>	4. 381 - 242 <u>139</u>
5. 758 - 476 <u>282</u>	6. 513 - 43 <u>470</u>
7. 310 - 175 <u>135</u>	8. 678 - 389 <u>289</u>
9. 1329 - 619 <u>710</u>	10. 1374 - 523 <u>851</u>
11. 1266 - 632 <u>634</u>	12. 1477 - 806 <u>671</u>
13. 1418 - 933 <u>485</u>	14. 1496 - 629 <u>867</u>
15. 1481 - 758 <u>723</u>	16. 1383 - 890 <u>493</u>
17. 1000 - 603 <u>397</u>	18. 1057 - 583 <u>474</u>
19. 1501 - 923 <u>578</u>	20. 1002 - 435 <u>567</u>
21. \$15.67 - 6.29 <u>\$9.38</u>	22. \$10.00 - 1.87 <u>\$8.13</u>
23. \$10.15 - 7.54 <u>\$2.61</u>	24. \$11.20 - 6.70 <u>\$4.50</u>

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LESSON ACTIVITY

Using the Pages

- In the addition section, Ex. 1 and 2 do not require regrouping. Ex. 3 and 4 require regrouping 10 ones as 1 ten. Ex. 5 and 6 require regrouping 10 tens as 1 hundred. Ex. 7 and 8 require two regroupings. Ex. 9-16 involve four-digit sums. Ex. 17, 18, 21, and 22 have three addends. Ex. 19-22 involve amounts of money.

In the subtraction section, Ex. 1 and 2 do not require regrouping. Ex. 3 and 4 require regrouping 1 ten as 10 ones. Ex. 5 and 6 require regrouping 1 hundred as 10 tens. Ex. 7 and 8 require two regroupings. Ex. 9-20 involve subtraction from a four-digit number. Ex. 17-20 are examples of regrouping with a zero as described on pages 94-95 and 246-247. Ex. 21-24 involve amounts of money.

In the multiplication section, the basic multiplication facts from Unit 8 are reviewed in preparation for Unit 15.

In the division section, the basic division facts from Unit 9 are reviewed in preparation for Unit 16.

To solve the word problems, the children must determine which operation — addition, subtraction, multiplication, division — is necessary.

- Encourage the children to work as quickly and as accurately as possible.
- These pages may be more interesting for the children and provide a more accurate assessment of their skills if they complete the sections over a period of several days.

Each section could be followed by review of the skills that are causing difficulty. You could adapt the lesson exercises, assessment, and/or one of the *Related Activities* for reinforcement on the appropriate page. The activity *Related Activities* on page T 293 may be appropriate.

Children who have demonstrated competence in the skills and the basic facts may benefit from using an activity from the *Related Activities* on page T 269 or in one of the preceding units.

Multiply.

1. 3×3 9
2. 4×2 8
3. 1×4 4
4. 2×3 6
5. 2×2 4
6. 3×5 15
7. 4×4 16
8. 6×3 18
9. 7×2 14
10. 4×3 12
11. 9×3 27
12. 7×4 28
13. 5×4 20
14. 7×3 21
15. 4×5 20
16. 6×5 30
17. 8×5 40
18. 8×4 32
19. 9×4 36
20. 9×5 45

Divide.

1. $8 \div 2$ 4
2. $4 \div 2$ 2
3. $9 \div 3$ 3
4. $5 \div 5$ 1
5. $8 \div 1$ 8
6. $18 \div 3$ 6
7. $16 \div 4$ 4
8. $15 \div 5$ 3
9. $12 \div 3$ 4
10. $16 \div 2$ 8
11. $21 \div 3$ 7
12. $25 \div 5$ 5
13. $24 \div 4$ 6
14. $27 \div 3$ 9
15. $20 \div 5$ 4
16. $35 \div 5$ 7
17. $32 \div 4$ 8
18. $45 \div 5$ 9
19. $40 \div 5$ 8
20. $36 \div 4$ 9

Solve.

1. 583 swimming tickets were sold in July. 735 were sold in August. How many tickets were sold in July and August? 1318
2. 1318 people used the pool. 550 were adults. How many were children? 768
3. Louie bought a volleyball for \$4.68. How much did he get back from \$10.00? \$5.32
4. A basketball costs \$7.89. The hoop and net cost \$3.50. How much for everything? \$11.39
5. The store had a sale on 1005 tennis balls. After two days, 87 were left. How many tennis balls were sold? 918
6. 118 women, 96 men and 92 children bought the tennis balls. How many bought tennis balls in all? 306
7. There are 15 girls. 3 are on each team. How many teams are there? 5
8. There are 4 events with 3 prizes in each event. How many prizes are there in all? 12
9. The children stand in 3 lines. There are 5 in each line. How many children are there? 15
10. The 20 boys are on 4 teams. The teams are equal in size. How many are on each team? 5
11. Each of the 7 girls has 5 pennies. How many pennies do the girls have? 35
12. The 4 boys share 28 pennies equally. How many pennies does each boy get? 7

RELATED ACTIVITIES

- For more practice, prepare copies of the following puzzle. (Copies of page T 365 may be used.)

a	2	b	8		c	2		d	4	e	5		f	9
	g	9	0	9					0			h	3	2
i	4		j	1	8				k	3	4			1
	l	2	4		m	3	5		n	8				
o	1	5		p	6	9		q	1			r	6	
	1		s	1		t	9	u	2	8		v	0	
	5		9					4			w	2	0	
x	7	4		y	1	0			z	1	6			

Across

- a. 7×4
- c. $8 \div 4$
- d. 9×5
- f. $27 \div 3$
- g. $523 + 386$
- h. 8×4
- i. $16 \div 4$
- j. 6×3
- k. $186 + 155$
- l. 6×4
- m. 7×5
- n. $32 \div 4$
- o. 3×5
- p. $746 - 677$
- q. 1×1
- r. 3×2
- s. $5 \div 5$
- t. $258 + 670$
- v. 4×0
- w. 5×4
- x. $101 - 27$
- y. 5×2
- z. 8×2

Down

- b. $426 - 337$
- c. $1007 - 709$
- d. 8×5
- e. $30 \div 6$
- f. $555 + 366$
- g. 3×3
- h. $762 - 414$
- i. 4×1
- j. 7×2
- k. 3×1
- l. 5×5
- m. $1000 - 601$
- o. $429 + 728$
- p. 6×1
- q. 9×2
- r. $400 + 200$
- s. $17 + 2$
- u. 8×3
- y. $5 \div 5$
- z. $1000 - 999$

- Children may enjoy the challenge of creating a puzzle similar to the one in the above activity for others to solve.

Unit 15 Overview

Multiplication

The primary objective of this unit is to ensure that the children maintain an understanding of multiplication concepts. The basic ways of representing multiplication are reviewed — equal groups, jumps on the number line, skip counting, and arrays. Basic number facts presented in Unit 8 are reviewed along with the commutative property of multiplication. The remaining basic number facts are introduced until all the basic multiplication facts have been discussed.

Later in the unit the standard multiplication algorithm is introduced. To accomplish this, multiplication with 10 and multiples of 10 is developed first. Then the children are given practice in using the multiplication algorithm and in solving related word problems.

Prerequisite Skills

- write multiplication sentences to describe equal groups, jumps on the number line, and arrays for basic multiplication facts with a second factor to 5
- find the product for a basic multiplication fact with a second factor to 5

Unit Outcomes

- write multiplication facts in horizontal and in vertical form to describe equal groups, jumps on a number line, and arrays
- find the product with 6, 7, 8, or 9 as a factor, to 9×6 , 9×7 , 9×8 , 9×9
- complete the basic multiplication facts; solve related word problems
- multiply a multiple of ten by a one-digit number
- multiply a two-digit number by a one-digit number, with or without regrouping
- use the standard algorithm to multiply a two-digit number by a one-digit number; solve related word problems
- solve problems having more than one solution

Background

In Unit 8 multiplication was introduced. The emphasis at that time was on exploring the concept through different approaches. Multiplication was shown to be represented by repeated addition, equal groups, jumps on the number line, and arrays. At the same time, the children were given the opportunity to investigate systematically the basic multiplication facts for which the second factor was 2, 3, 4, or 5. These concepts are reviewed in the first lesson of Unit 15 along with the commutative property of multiplication, which enables the children to review multiplication facts in related pairs, for example, $4 \times 3 = 12$ and $3 \times 4 = 12$.

In this unit the basic multiplication facts for which the second factor is 6, 7, 8, or 9 are introduced. Many of these facts may have been encountered in Unit 8 as a result of investigating the commutative property of multiplication at that time. Children learned that the order of multiplying two numbers does not change the product. For example, for Ex. 3 on page 155 it was seen that the product of 6 and 3 could be written two ways and that these ways could be derived from one array, either the array in A or the array in B. Thus, in learning $6 \times 3 = 18$ for facts of *three*, children may also have learned $3 \times 6 = 18$, a fact of *six*.

A



$$3 \times 6 = 18$$

$$6 \times 3 = 18$$

B



$$6 \times 3 = 18$$

$$3 \times 6 = 18$$

The commutative property of multiplication is observed more clearly in the multiplication table on page 276, which summarizes the basic multiplication facts.

In preparation for the standard algorithm, the vertical form for multiplication is introduced in the first lesson. The algorithm is introduced later in the unit after practice with basic multiplication facts is provided. Just as the algorithms for addition and subtraction were presented through a series of steps, so is the algorithm for multiplication. These steps involve:

- multiplication of 10 and of multiples of 10 to 90;
- multiplication with no regrouping;
- multiplication with regrouping;
- multiplication using the standard algorithm.

Throughout these steps the concept of place value for two-digit numbers is applied and the multiplication of two-digit numbers is related to corresponding basic multiplication facts.

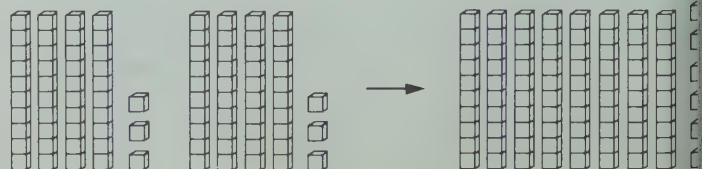
In the first stage, a multiple of 10 is multiplied by a one-digit number, for example, 6×30 . To complete the multiplication children are led to think of 30 as 3 tens. 6×3 tens is completed by applying the basic multiplication fact $6 \times 3 = 18$. Thus 6×3 tens equals 18 tens, which is the same as 1 hundred 8 tens or 180.

3 tens	30
$\times 6$	$\times 6$
18 tens	180

The above procedure is applied in multiplication of a two-digit number by a one-digit number with no regrouping. Children encounter partial products, the sum of which gives the final product. In the following example, 43 is thought of as tens 3 ones ($40 + 3$). Children are accustomed to performing addition and subtraction from right to left; this same order is used in multiplication. First, the ones are multiplied by 2, then the tens are multiplied by 2.

	tens	ones	
43	4	3	
$\times 2$	\times	2	
partial products	6	0	$2 \times 3 \text{ ones} = 6 \text{ ones}$
	8	6	$2 \times 4 \text{ tens} = 8 \text{ tens}$
	8	6	

This procedure can be illustrated using models of tens and ones. When 2×43 is shown as 2 groups of 43, there are 2 groups of ones (6) and 2 groups of 4 tens (8 tens or 80).



In some cases, multiplication of the ones may give a two-digit number. This presents no difficulty if the partial products of ones and of tens are recorded separately and then added, as shown below. The regrouping occurs in the addition step.

$$\begin{array}{r}
 43 \\
 \times 7 \\
 \hline
 21 \leftarrow 7 \times 3 \text{ ones} = 21 \text{ ones (2 tens 1 one)} \\
 280 \leftarrow 7 \times 4 \text{ tens} = 28 \text{ tens} \\
 \hline
 301 \quad \text{(2 hundreds 8 tens)}
 \end{array}$$

Children may use models of hundreds, tens, and ones to demonstrate that 7 groups of 43 may be joined to show 21 ones and 28 tens. These in turn may be regrouped to show 3 hundreds, 0 tens, and 1 one.

It is essential that children understand the underlying concepts before the standard algorithm is approached. In using the standard algorithm, the products of ones and of tens are shown only one line, and the regrouping occurs as an extra step after multiplying the tens, but before recording them.

$$\begin{array}{r}
 \boxed{2} \\
 43 \\
 \times 7 \\
 \hline
 301
 \end{array}$$

$7 \times 3 \text{ ones} = 21 \text{ ones (}\boxed{2}\text{ tens 1 one)}$
 $7 \times 4 \text{ tens} = 28 \text{ tens}$
 Add the $\boxed{2}$ tens: $(28 \text{ tens} + 2 \text{ tens} = 30 \text{ tens})$
 (3 hundreds 0 tens)

Because of the inherent difficulties in using the standard algorithm, the sequential development recording the partial products of ones and tens is extremely important.

Teaching Strategies

Methods similar to those used in Unit 8 can be continued throughout Unit 15. It is important to use concrete materials to produce each new set of multiplication facts. Materials can include counters, felt cutouts on a flannel board, magnetic counters on a magnetic board, and cutouts or gummed shapes pasted on sheets of paper. Each illustration should be followed by the corresponding multiplication sentence. The first lesson reviews the use of equal groups, the number line, and arrays to show multiplication, and these aids may be used as needed throughout Unit 15.

As soon as it is apparent that the children understand the concept of multiplication, a class program may be established to have them learn the basic multiplication facts from memory. A short time may be set aside each day for review and practice of the facts sequentially from facts of 1 to facts of 9. A variety of games and activities are included in the *Related Activities* that accompany the teaching suggestions for each lesson. In any particular game, each child needs an opportunity to answer an equal number of exercises without undue pressure from her/his peers. Highly competitive games should be avoided.

To keep a record of multiplication facts that have been mastered, each child may prepare a card similar to the one illustrated. The card may be marked by the teacher as each set of facts is mastered. In this illustration, facts of 2, 3, and 5 are shown to have been mastered. Zero and one as factors may be evaluated in terms of understanding their effects in multiplication, rather than from a set of products.

Name _____									
I know multiplication facts of									
0	1	2	3	4	5	6	7	8	9
		•	•		•				

It is important that children develop accurate recall of multiplication facts. Poor recall of the basic facts can impede an understanding of the algorithm.

Prior to the work for multiplication of a two-digit number by a one-digit number, it would be advisable to review place-value concepts for two-place numerals. Review that a two-place numeral can be interpreted in terms of tens and ones. Have children use models of tens and ones to represent numbers to 99. Up to nine children in a group can use models of hundreds, tens, and ones to illustrate the equal groups aspect of multiplication. For example, for 4×36 , each of four children can represent 36 using 3 tens and 6 ones. The four groups of models may be joined and seen as 12 tens 24 ones. Then, 20 ones may be regrouped as 2 tens, and 10 tens may be regrouped as 1 hundred to show 1 hundred 4 tens 4 ones, or the product 144.

$$\begin{array}{r}
 36 \\
 \times 4 \\
 \hline
 24 \\
 120 \\
 \hline
 144
 \end{array}$$

As not a great deal of Unit 15 is devoted to the standard algorithm, some children may have difficulty in grasping quickly the mental regrouping that is required. Consequently, you may wish to delay multiplication using the standard algorithm with regrouping for development in the fourth year of the elementary mathematics program. Multiplication of two-digit numbers at this time can be left at the stage of showing the partial products for ones and tens, and finding their sum.

Materials

display board, 15 objects for the display board
 copies of page T 359 for each child
 counters for each child
 two blank cards for each child
 models for hundreds, tens, and ones
 dimes and pennies (optional)
 overhead projector and a transparency showing a copy of the multiplication table on page 276 (optional)

Vocabulary

multiple algorithm standard form

LESSON OUTCOME

Write multiplication facts in horizontal and in vertical form to describe equal groups, jumps on a number line, and arrays

Materials

a display board, 15 objects, number lines from copies of page T359

Prerequisite Skills

Count by twos and fives; add threes and fours starting from zero

Checking Prerequisite Skills

Complete these patterns.

- 2, 4, 6, 8, 10, 12, 14, 16, 18
- 3, 6, 9, 12, 15, 18, 21, 24, 27
- 4, 8, 12, 16, 20,
24, 28, 32, 36
- 5, 10, 15, 20, 25,
30, 35, 40, 45

15 MULTIPLICATION

Showing Multiplication

There are different ways to show that the product of 3 and 5 is 15.

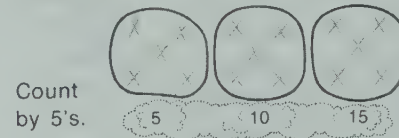
It can be written four ways:

$$\begin{array}{r} 3 \times 5 = 15 \\ 5 \times 3 = 15 \end{array} \quad \begin{array}{r} 5 \\ \times 3 \\ \hline 15 \end{array} \quad \begin{array}{r} 3 \\ \times 5 \\ \hline 15 \end{array}$$

No matter how it's shown, two numbers always have the same product.

It can be shown with a picture:

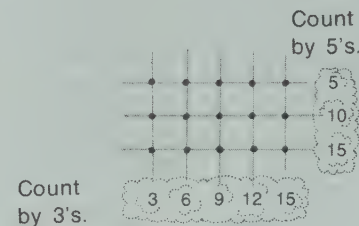
Draw 3 groups of 5.



Draw 3 jumps of 5 on a number line.



Draw 3 rows, 5 columns of dots.



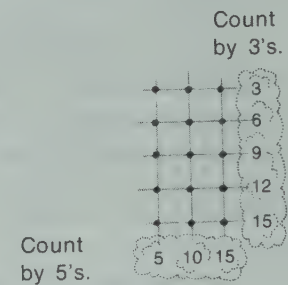
Draw 5 groups of 3.



Draw 5 jumps of 3 on a number line.



Draw 5 rows, 3 columns of dots.



LESSON ACTIVITY

Before Using the Pages

- Write 3×5 on the board. Review that the symbol \times is read "times", that the name of the operation is multiplication, and that the exercise can be interpreted as three groups of five or three fives. Have a child place three groups of five objects on the display board and have another child show the addition $5 + 5 + 5$ on the board. Ask how many objects there are in all and complete the sentence $3 \times 5 = \underline{\quad}$.

Write the exercise 5×3 on the board. Ask how the display should be changed and whether the total number of objects will be the same as before. Have a child alter the display to show five groups of three, and have another child show the addition $3 + 3 + 3 + 3 + 3$. Complete the sentence $5 \times 3 = \underline{\quad}$.

Using the Pages

- Remind the children that in their earlier work they used pictures to show multiplication. Give them time to study the examples on page 268 on their own. These examples review drawing equal groups, showing equal jumps on a number line, and drawing a rectangular array of dots. For each of these methods, two pictures are shown to illustrate that the order of the factors does not affect the product. The vertical notation for multiplication is introduced in preparation for the standard algorithm for multiplication.

Ask the following questions about what the children have read.

- "For three times five equals fifteen, what number is the product?"
- "What is one way to show groups for the product three and five?"
"What is another way?"
"Is the product the same for each way?"
- "How can the product of three and five be shown on a number line?"

Working Together

Draw groups to show each product two ways.

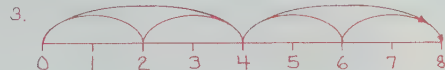
Example: For the product of 4 and 3, draw



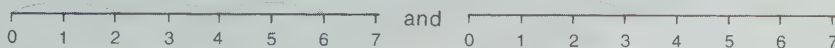
1. Show the product of 5 and 2.

2. Show the product of 3 and 6.

Draw number lines and show each product two ways.



Example: For the product of 3 and 2, draw



3. Show the product of 2 and 4.

4. Show the product of 7 and 3.

Draw two arrays that show the product of this pair.

5. 3 and 8



Write the product of this pair four ways.

$$\begin{array}{l} 6 \text{ and } 56 \times 5 = 30 \\ 5 \times 6 = 30 \end{array} \quad \begin{array}{r} 5 \\ \times 6 \\ \hline 30 \end{array} \quad \begin{array}{r} 6 \\ \times 5 \\ \hline 30 \end{array}$$

Exercises

Draw groups to show the product of each pair two ways. Write each product four ways.

$$\begin{array}{l} 6 \times 2 = 12 \quad 2 \times 6 = 12 \\ 1 \times 6 = 6 \quad 6 \times 1 = 6 \end{array} \quad \begin{array}{l} 4 \times 1 = 4 \quad 1 \times 4 = 4 \\ 1 \times 4 = 4 \quad 4 \times 1 = 4 \end{array} \quad \begin{array}{l} 5 \times 4 = 20 \quad 4 \times 5 = 20 \\ 2 \times 5 = 10 \quad 5 \times 2 = 10 \end{array} \quad \begin{array}{l} 3 \times 7 = 21 \quad 7 \times 3 = 21 \\ 1 \times 7 = 7 \quad 7 \times 1 = 7 \end{array}$$

Draw number lines and show the product of each pair two ways. Write each product four ways.

$$\begin{array}{l} 3 \times 2 = 6 \quad 2 \times 3 = 6 \\ 1 \times 3 = 3 \quad 3 \times 1 = 3 \end{array} \quad \begin{array}{l} 1 \times 6 = 6 \quad 6 \times 1 = 6 \\ 1 \times 6 = 6 \quad 6 \times 1 = 6 \end{array} \quad \begin{array}{l} 6 \times 3 = 18 \quad 3 \times 6 = 18 \\ 2 \times 3 = 6 \quad 3 \times 2 = 6 \end{array} \quad \begin{array}{l} 2 \times 8 = 16 \quad 8 \times 2 = 16 \\ 1 \times 8 = 8 \quad 8 \times 1 = 8 \end{array}$$

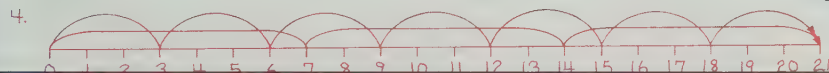
Draw two arrays that show the product of each pair. Write each product four ways.

$$\begin{array}{l} 3 \times 4 = 12 \quad 4 \times 3 = 12 \\ 1 \times 4 = 4 \quad 4 \times 1 = 4 \end{array} \quad \begin{array}{l} 8 \times 1 = 8 \quad 1 \times 8 = 8 \\ 1 \times 8 = 8 \quad 8 \times 1 = 8 \end{array} \quad \begin{array}{l} 7 \times 5 = 35 \quad 5 \times 7 = 35 \\ 2 \times 5 = 10 \quad 5 \times 2 = 10 \end{array} \quad \begin{array}{l} 2 \times 9 = 18 \quad 9 \times 2 = 18 \\ 1 \times 9 = 9 \quad 9 \times 1 = 9 \end{array}$$

Multiply. Draw a picture if you need to.

$$\begin{array}{r} 13. \quad 2 \\ \times 7 \\ \hline 14 \end{array} \quad \begin{array}{r} 14. \quad 4 \\ \times 4 \\ \hline 16 \end{array} \quad \begin{array}{r} 15. \quad 9 \\ \times 3 \\ \hline 27 \end{array} \quad \begin{array}{r} 16. \quad 1 \\ \times 8 \\ \hline 8 \end{array} \quad \begin{array}{r} 17. \quad 7 \times 4 \quad 28 \\ 18. \quad 5 \times 5 \quad 25 \end{array}$$

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"Is there more than one way?"

"Do both number lines show the same product?"

4. "How many dots are shown for three rows and five columns?"

"How is the other arrangement of dots different?"

"Is the product the same?"

Review the terms *array* and *factor*. Point out that drawing horizontal and vertical lines shows the rows and columns of dots in an array more quickly. Draw the children's attention to the four ways at the top of page 268 for writing the multiplication fact. Review the term *vertical form*.

Working Together: For these exercises, children practice showing multiplication in the ways reviewed in the worked example. The emphasis is placed on the fact that the order of the two factors can be changed without affecting their product. Children may find it helpful to refer to the worked example for assistance, particularly for Ex. 6. Use similar exercises as needed.

RELATED ACTIVITIES

- Review the role of 0 and 1 as factors in multiplication.
- Have children illustrate the product of equal factors for 1×1 to 5×5 , using each of the three methods shown in the worked example. Point out that the shape of each array is square.
- Children may play the game "Find Our Product" described on page T350.

Exercises: By showing pictures for multiplication and by showing each product four ways, children develop a better understanding of multiplication concepts. For Ex. 13-18, encourage the children to use pictures only if they do not remember a product.

Assessment

1. Draw groups to show the product of 4 and 3 two ways. Write the product four ways.
2. Draw number lines and show the product of 5 and 7 two ways. Write the product four ways.
3. Draw two arrays that show the product of 3 and 6. Write the product four ways.

$$\begin{array}{l} 1. \quad 4 \times 3 = 12 \\ \quad 3 \times 4 = 12 \end{array} \quad \begin{array}{l} 2. \quad 5 \times 7 = 35 \\ \quad 7 \times 5 = 35 \end{array} \quad \begin{array}{l} 3. \quad 3 \times 6 = 18 \\ \quad 6 \times 3 = 18 \end{array}$$

$$\begin{array}{r} 3 \\ \times 4 \\ \hline 12 \end{array} \quad \begin{array}{r} 4 \\ \times 3 \\ \hline 12 \end{array} \quad \begin{array}{r} 7 \\ \times 5 \\ \hline 35 \end{array} \quad \begin{array}{r} 5 \\ \times 7 \\ \hline 35 \end{array} \quad \begin{array}{r} 6 \\ \times 3 \\ \hline 18 \end{array} \quad \begin{array}{r} 3 \\ \times 6 \\ \hline 18 \end{array}$$

LESSON OUTCOME

Find the product with 6 as a factor, to 9×6

Prerequisite Skills

Add sixes

Checking Prerequisite Skills

Add 6 each time to complete the pattern.

1. 6, 12, 18, 24, 30, 36, 42, 48, 54

RELATED ACTIVITIES

- Adapt one or more of the counting activities described on pages T158, T159, and T163, for multiples of 6.
- Give each child a copy of page T360. Have the children number the squares in sequence from 1 to 60. Have them color inside every sixth square to show the multiples of 6.
- Have children demonstrate multiplication facts with 6 as the second factor by showing jumps on a number line.

6 as a Factor

How many apples in a case?

$$6 \times 4 = 24$$

Count
6 fours:

Count
4 sixes:

$$4 \times 6 = 24$$

There are 24 apples in a case.

Exercises

How many apples in

- 1 row of 6? 6
- 3 rows of 6? 18
- 5 rows of 6? 30
- 7 rows of 6? 42
- 9 rows of 6? 54
- 0 rows of 6? 0

Multiply. Draw a picture if you need to.

- | | | | | |
|---|---|--|---|---|
| 7. 8×6 <u>48</u> | 8. 9×6 <u>54</u> | 9. 6×6 <u>36</u> | 10. 2×6 <u>12</u> | 11. 1×6 <u>6</u> |
| 12. 7×6 <u>42</u> | 13. 5×6 <u>30</u> | 14. 0×6 <u>0</u> | 15. 4×6 <u>24</u> | 16. 3×6 <u>18</u> |
| 17. $\begin{array}{r} 6 \\ \times 3 \\ \hline 18 \end{array}$ | 18. $\begin{array}{r} 6 \\ \times 9 \\ \hline 54 \end{array}$ | 19. $\begin{array}{r} 6 \\ \times 1 \\ \hline 6 \end{array}$ | 20. $\begin{array}{r} 6 \\ \times 7 \\ \hline 42 \end{array}$ | 21. $\begin{array}{r} 3 \\ \times 6 \\ \hline 18 \end{array}$ |
| 23. $\begin{array}{r} 6 \\ \times 8 \\ \hline 48 \end{array}$ | 24. $\begin{array}{r} 5 \\ \times 6 \\ \hline 30 \end{array}$ | 25. $\begin{array}{r} 6 \\ \times 0 \\ \hline 0 \end{array}$ | 26. $\begin{array}{r} 2 \\ \times 6 \\ \hline 12 \end{array}$ | 27. $\begin{array}{r} 6 \\ \times 4 \\ \hline 24 \end{array}$ |
| | | | | 28. $\begin{array}{r} 6 \\ \times 6 \\ \hline 36 \end{array}$ |

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LESSON ACTIVITY

Before Using the Page

- Have the children draw two arrays to show the product of 2 and 4. Then have them write the product four ways. Lead them to realize that since one of the factors is 4, the array shows either 4 rows or 4 columns. Tell the children that for today's lesson, one of the two factors is always 6. Ask what this indicates about the arrays that show the products. Establish that there will be either 6 rows or 6 columns.

Using the Page

- Point out that the apples in a case form an array. Looking at the array from one point of view, the children can see 4 rows and 6 columns. They may turn their books to see the array having 6 rows and 4 columns. Discuss the two ways of counting to 24 (by fours and by sixes). Relate each way to the corresponding multiplication sentence. Emphasize

that there is the same number of apples for four groups of six as for six groups of four. Ask questions such as: "How many apples are in two rows of six?"

Exercises: Ex. 1-6 establish basic facts with six as the second factor. Children may use the illustration in the worked example to help them complete the exercises. For Ex. 7-28 children may draw pictures of groups, number lines, or arrays if necessary.

When the children have finished the exercises, have them name pairs of exercises that show the same product, for example, Ex. 19 and 22.

Assessment

Multiply. Draw a picture if you need to.

- 5×6 30
- 8×6 48
- $\begin{array}{r} 9 \\ \times 6 \\ \hline 54 \end{array}$
- $\begin{array}{r} 6 \\ \times 7 \\ \hline 42 \end{array}$

LESSON OUTCOME

Find the product with 7 as a factor, to 9×7

Prerequisite Skills

Add sevens

Checking Prerequisite Skills

Add 7 each time to complete the pattern.

1. 7, 14, 21, 28, 35, 42, 49, 56, 63

RELATED ACTIVITIES

• Children may play the game “Green Giveaway”. Prepare sets of three cards. Each set consists of a green card showing a multiplication exercise, another green card showing the same multiplication exercise with the factors in the opposite order, and a yellow card showing the product. Shuffle the cards and deal the same number to each player. Each player looks for “books” in her/his cards and places the books in her/his own pile of cards. A book consists of two green cards and one yellow card indicating the same number. One example is shown below.

4×7	7×4	28
--------------	--------------	----

(green) (green) (yellow)

Then one player designated as the leader states, “Giveaway green” and each player gives one green card to the player on her/his right. The game continues until one player has no more cards. The player with the most books is the winner.

“What is the product of seven and five?”

If necessary, have them draw pictures to show that such products are equal.

Exercises: Children may refer to the table in *Working Together* for assistance or they may draw pictures.

After the children have finished the exercises, have them name exercises that show the same product, such as Ex. 12 and 16.

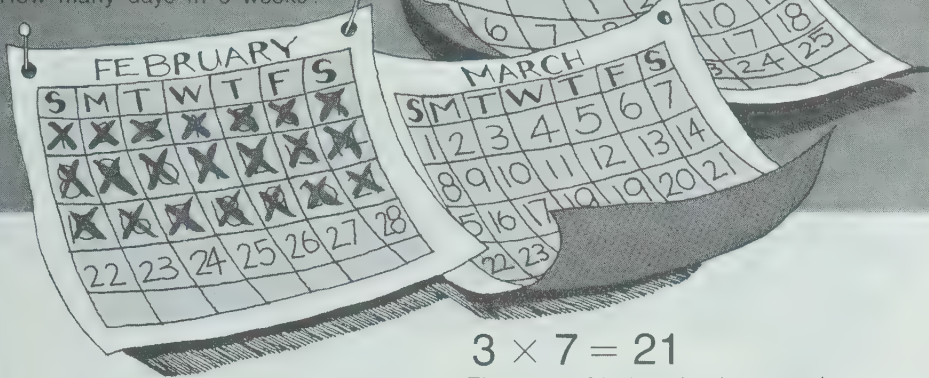
Assessment

Multiply.

1. 8×7 56 2. 4×7 28 3. 7
 $\times 7$
49 4. 7
 $\times 9$
63

7 as a Factor

There are 7 days in a week.
How many days in 3 weeks?



$$3 \times 7 = 21$$

There are 21 days in three weeks.

Working Together

Continue the patterns and complete this table.

1.	Number of weeks	1	2	3	4	?	?	?	?	?
	Days in each week	7	7	7	?	?	?	?	?	?
	Days in all	7	14	?	?	?	?	?	?	?

21 28 35 42 49 56 63

Exercises

Multiply.

- 3×7 21
- 5×7 35
- 8×7 56
- 2×7 14
- 4×7 28
- 6×7 42
- 7×7 49
- 0×7 0
- 9×7 63
- 1×7 7
- 7
 $\times 6$
42
- 7
 $\times 1$
7
- 3
 $\times 7$
21
- 7
 $\times 7$
49
- 7
 $\times 4$
28
- 1
 $\times 7$
7
- 7
 $\times 8$
56
- 7
 $\times 0$
0
- 7
 $\times 9$
63
- 6
 $\times 7$
42
- 4
 $\times 7$
28
- 7
 $\times 3$
21

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LESSON ACTIVITY

Using the Page

Seven is introduced as a factor in connection with the number of days in one week. Discuss the calendar for February. Ask what the capital letter headings represent. Then ask how many days are in one week. Read the statement at the top of the page for the word problem. Develop that for three weeks, there are three groups of seven days, and thus, a multiplication sentence can be used to express the number of days in all.

Working Together: The completed table will summarize the basic facts with seven as a factor. The arrangement of numerals in the table suggests exercises in the vertical form for 1 to 9.

$$\begin{array}{r} \times 7 \\ \times 7 \end{array}$$

When the children have completed the exercises, have them refer to the tables to answer questions such as:

“What is the product of five and seven?”

OBJECTIVE

Demonstrate competence in completing basic multiplication facts, one factor to 7

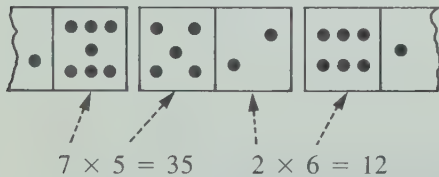
RELATED ACTIVITIES

- Prepare multiplication tables and number wheels similar to the following for the children to complete. (Copies of page T 367 may be used.)

×	6
4	?
?	54
7	?



- Small groups of children may use a set of dominoes in the following way. One domino is turned face up. The remaining dominoes are distributed equally among the players. Players, in turn, place dominoes end to end to form a row. A player may place any domino to continue the row if he/she can name the product of the numbers for the two ends that are adjoining.



A player may also place a card showing the multiplication fact beside the appropriate dominoes. These cards can be used for checking the placement of the dominoes.

Practice

Multiply.

- $2 \times 6 = 12$
- $2 \times 7 = 14$
- $3 \times 7 = 21$
- $3 \times 6 = 18$
- $4 \times 6 = 24$
- $6 \times 5 = 30$
- $7 \times 5 = 35$
- $7 \times 6 = 42$
- $6 \times 6 = 36$
- $6 \times 7 = 42$
- $7 \times 7 = 49$

Copy and complete the patterns.

- 6, 12, 18, 24, \dots , 48, \dots
- 7, 14, \dots , 28, \dots , 49, \dots

Copy and complete these multiplication tables.

×	6	7
4	24	28
5	30	35

×	6	7
6	36	42
7	42	49

×	6
1	6
2	12
3	18
4	24
5	30
6	36
7	42
8	48
9	54

×	7
1	7
2	14
3	21
4	28
5	35
6	42
7	49
8	56
9	63

×	3	6	0	7	2
5	15	30	0	35	10
1	3	6	0	7	2
7	21	42	0	49	14
4	12	24	0	28	8
6	18	36	0	42	12

Complete.

- $2 \times \text{?} = 12$
- $3 \times \text{?} = 21$
- $8 \times \text{?} = 48$
- $7 \times \text{?} = 42$
- $6 \times \text{?} = 42$
- $\text{?} \times 6 = 0$
- $\text{?} \times 7 = 49$
- $1 \times \text{?} = 7$

Copy and complete these multiplication tables.

×	7
2	14
3	21

×	4	6
4	16	24
6	24	36

×	1	6
7	7	42
3	3	18

×	5	7
7	35	49
6	30	42

Write $<$, $>$, or $=$ to complete each sentence.

- $7 \times 0 \text{ ? } 7 + 0$
- $6 \times 3 \text{ ? } 3 \times 6$
- $7 \times 2 \text{ ? } 8 + 6$
- $4 \times 6 \text{ ? } 3 \times 7$
- $7 \times 1 \text{ ? } 7 =$
- $7 \times 5 \text{ ? } 6 \times 6$
- $6 \times 1 \text{ ? } 6 + 1$
- $6 \times 5 \text{ ? } 7 \times 4$
- $8 \times 3 \text{ ? } 6 \times 4$

LESSON ACTIVITY

Using the Page

- Children may need to draw pictures to help them find products. Ex. 19-30 involve missing factors in preparation for the work with division in Unit 16. The tables for Ex. 1 and 17 summarize basic facts with 6 or 7 as the second factor. The table for Ex. 18 is challenging since the factors are not arranged in sequence.

For the tables, it is important to review that the first factor is chosen from the left column and the second factor is chosen from the top row. For example, the multiplication fact indicated in Ex. 14 is $4 \times 6 = 24$.

You may wish to review the symbols $>$ and $<$ before the children begin Ex. 31-39. Some of the exercises involve addition as well as multiplication.

LESSON OUTCOME

Find the product with 8 as a factor, to 9×8

Prerequisite Skills

Add eights

Checking Prerequisite Skills

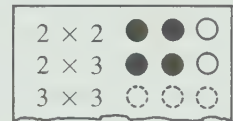
Add 8 each time to complete the pattern.

1. 8, 16, 24, 32, 40, 48, 56, 64, 72

RELATED ACTIVITIES

• The first three activities on page T 298 may be adapted for multiples of 8.

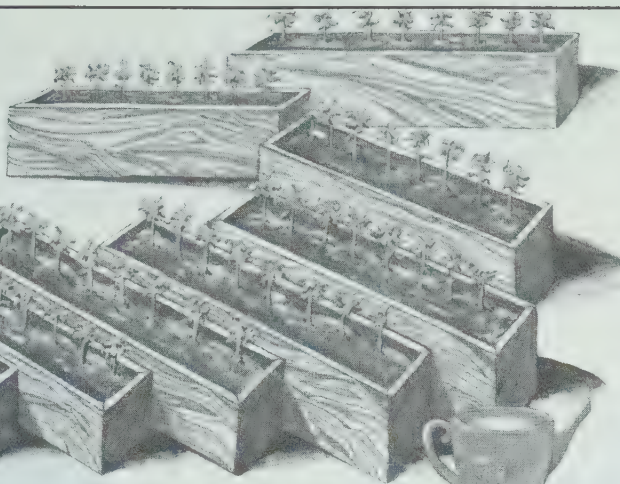
• Lead the children in the following activity. Write 2×2 on the board. Show a two-by-two array of dots. Write 2×3 beneath the first exercise on the board. Have a child draw dots to extend the first array to form a two-by-three array.



Continue the process with 3×3 , 3×4 , 4×4 , 4×5 , 5×5 , 5×6 , 6×6 , 6×7 , 7×7 , 7×8 , 8×8 . Discuss how the size of the first array increases in stages to form an eight-by-eight array. For each stage, have a child give the multiplication sentence.

8 as a Factor

9 boxes. 8 seedlings in each box. How many seedlings in all?



$$9 \times 8 = 72$$

There are 72 seedlings in all.

Exercises

How many seedlings in

1. 2 boxes? 2. 4 boxes? 3. 6 boxes? 4. 8 boxes? 5. 0 boxes?

Multiply.

6. $1 \times 8 = 8$ 7. $3 \times 8 = 24$ 8. $5 \times 8 = 40$ 9. $7 \times 8 = 56$ 10. $8 \times 7 = 56$
11. $8 \times 8 = 64$ 12. $8 \times 5 = 40$ 13. $8 \times 0 = 0$ 14. $8 \times 3 = 24$ 15. $8 \times 6 = 48$

16. $\begin{array}{r} 8 \\ \times 4 \\ \hline 32 \end{array}$ 17. $\begin{array}{r} 8 \\ \times 9 \\ \hline 72 \end{array}$ 18. $\begin{array}{r} 8 \\ \times 2 \\ \hline 16 \end{array}$ 19. $\begin{array}{r} 8 \\ \times 5 \\ \hline 40 \end{array}$ 20. $\begin{array}{r} 8 \\ \times 7 \\ \hline 56 \end{array}$ 21. $\begin{array}{r} 8 \\ \times 3 \\ \hline 24 \end{array}$
22. $\begin{array}{r} 1 \\ \times 8 \\ \hline 8 \end{array}$ 23. $\begin{array}{r} 8 \\ \times 6 \\ \hline 48 \end{array}$ 24. $\begin{array}{r} 4 \\ \times 8 \\ \hline 32 \end{array}$ 25. $\begin{array}{r} 8 \\ \times 0 \\ \hline 0 \end{array}$ 26. $\begin{array}{r} 6 \\ \times 8 \\ \hline 48 \end{array}$ 27. $\begin{array}{r} 2 \\ \times 8 \\ \hline 16 \end{array}$

Complete.

28. $\begin{array}{r} 3 \\ \times 8 \\ \hline \end{array} = 24$ 29. $\begin{array}{r} 1 \\ \times 8 \\ \hline \end{array} = 8$ 30. $\begin{array}{r} 8 \\ \times 2 \\ \hline \end{array} = 16$ 31. $8 \times \begin{array}{r} 7 \\ \hline \end{array} = 56$
32. $8 \times \begin{array}{r} 3 \\ \hline \end{array} = 24$ 33. $8 \times \begin{array}{r} 5 \\ \hline \end{array} = 40$ 34. $8 \times \begin{array}{r} 6 \\ \hline \end{array} = 48$ 35. $8 \times \begin{array}{r} 4 \\ \hline \end{array} = 32$

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LESSON ACTIVITY

Singing the Page

Eight was presented as a factor in earlier work with the numbers two to seven as factors. On page 273, there are only two new facts involving eight, $8 \times 8 = 64$ and $9 \times 8 = 72$.

Review instances encountered earlier when 8 was one factor, such as $8 \times 2 = 16$, $8 \times 3 = 24$, and $8 \times 4 = 32$. For each of these, write its related fact ($2 \times 8 = 16$, $3 \times 8 = 24$, and $4 \times 8 = 32$). Continue the pairs of facts to $8 \times 7 = 56$ and $7 \times 8 = 56$. To the product 56 add 8 to discover the fact $8 \times 8 = 64$, and to 64 add another 8 to discover the fact $9 \times 8 = 72$.

The worked example provides an opportunity to emphasize the advantage of learning multiplication facts. It would be a tedious task to count by ones to find out the number of plants in all. Ask the following questions.

“How many boxes are shown?”

“How many seedlings are in each box?”

“What multiplication sentence shows the number of seedlings in all?”

Exercises: The worked example presents the multiplication fact $9 \times 8 = 72$. Ask which exercise has a product of 72 (Ex. 17).

Ex. 1-5 refer to the illustration in the worked example. Children may use the illustration to help them complete the exercises. They may also draw pictures or use number lines.

When they have finished, have them compare Ex. 28 and 32. Establish that 3×8 and 8×3 name the same product.

Assessment

Multiply.

1. $4 \times 8 = 32$ 2. $8 \times 7 = 56$ 3. $\begin{array}{r} 9 \\ \times 8 \\ \hline \end{array}$ 4. $\begin{array}{r} 8 \\ \times 6 \\ \hline \end{array}$
 72 48

Complete.

5. $5 \times 8 = 40$ 6. $8 \times 7 = 56$ 7. $0 \times 8 = 0$

LESSON OUTCOME

Find the product with 9 as a factor, to 9×9

Materials

counters, two blank cards for each child

Prerequisite Skills

Add nines

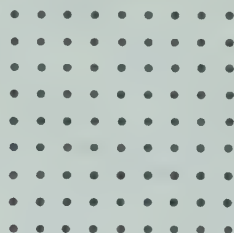
Checking Prerequisite Skills

Add 9 each time to complete the pattern.

- 9, 18, 27, 36, 45, 54, 63, 72, 81

Finding Products with Factors to 9

This array shows $9 \times 9 = 81$.
You can cover rows and columns to show other products.



$$9 \times 9 = 81$$

This shows the product of 6 and 8.

$$6 \times 8 = 48$$



DAHL
UNWIN'S DWARF
MIXED COLOR

CABBAGE
GOLDEN ACRE RESISTANT



Working Together Multiplication sentences with the factors in the opposite order are acceptable.

Name the picture that shows each product. Then show each product in a multiplication sentence.

- 1×8 A, $1 \times 8 = 8$
- 2×9 B, $2 \times 9 = 18$
- 9×3 D, $9 \times 3 = 27$
- 8×2 C, $8 \times 2 = 16$

Use cards on the array above to find each product.

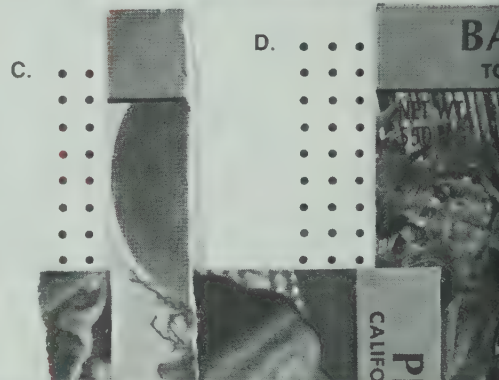
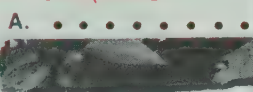
$$\begin{array}{r} 9 \\ \times 6 \\ \hline 54 \end{array} \quad \begin{array}{r} 9 \\ \times 8 \\ \hline 72 \end{array} \quad \begin{array}{r} 8 \\ \times 9 \\ \hline 72 \end{array}$$

Complete the table.

8.	Number of rows	1	3	5	7	9
	Seeds in each row	9	9	9	9	9
	Seeds in all	?	?	?	?	?

27 45 63 81

274



LESSON ACTIVITY

Before Using the Pages

- Have each of nine children, in turn, take 9 counters and place them on a table. Add and then record in a chart the total number of counters after each group of 9 is placed. Summarize the results by stating, "For nine groups of nine counters there are eighty-one counters in all." Ask what multiplication sentence expresses this fact. Show the sentence $9 \times 9 = 81$ on the board. Ask children to describe an array for $9 \times 9 = 81$. Emphasize the number of rows, the number of columns, and the number in all.

Using the Pages

- Have the children compare their idea of the array for 9×9 with the array for 9×9 on page 274. The new basic multiplication fact for the children to consider is $9 \times 9 = 81$. The worked example demonstrates that the nine-by-nine array can be partially covered to show arrays for other basic multiplication facts.

Read the statement at the top of page 274 to introduce the situation. Have each child use two cards to cover the nine-by-nine array to show how the six-by-eight array is obtained as illustrated. Point out that this array has 6 rows and 8 columns. Have the children use their cards to cover the nine-by-nine array a different way to show the product of 6 and 8 (8 rows, 6 columns). Review that 6×8 and 8×6 name the same product. Repeat this procedure for other exercises; for example, state, "Show an array for the product of five and three."

Working Together: Ex. 1-4 relate to the four diagrams labeled A, B, C, and D. This helps the children understand ways of partially covering the nine-by-nine array to show arrays for other basic multiplication facts. Have children explain how each array shows the product named. For Ex. 4, the product for 8×2 is shown by array C because the array has 8 rows and 2 columns. Children may use the nine-by-nine array in the worked example to help them complete the table for Ex. 8.

Exercises

Multiply. Use cards on the 9×9 array if you need to.

1. 3×9 27 2. 4×9 36 3. 7×9 63 4. 9×1 9 5. 8×3 24
6. 3×8 24 7. 9×9 81 8. 8×8 64 9. 7×7 49 10. 9×0 0

11. $\begin{array}{r} 2 \\ \times 9 \\ \hline 18 \end{array}$ 12. $\begin{array}{r} 9 \\ \times 5 \\ \hline 45 \end{array}$ 13. $\begin{array}{r} 9 \\ \times 1 \\ \hline 9 \end{array}$ 14. $\begin{array}{r} 5 \\ \times 9 \\ \hline 45 \end{array}$ 15. $\begin{array}{r} 8 \\ \times 4 \\ \hline 32 \end{array}$ 16. $\begin{array}{r} 8 \\ \times 7 \\ \hline 56 \end{array}$
17. $\begin{array}{r} 6 \\ \times 8 \\ \hline 48 \end{array}$ 18. $\begin{array}{r} 6 \\ \times 9 \\ \hline 54 \end{array}$ 19. $\begin{array}{r} 8 \\ \times 5 \\ \hline 40 \end{array}$ 20. $\begin{array}{r} 8 \\ \times 8 \\ \hline 64 \end{array}$ 21. $\begin{array}{r} 1 \\ \times 8 \\ \hline 8 \end{array}$ 22. $\begin{array}{r} 4 \\ \times 7 \\ \hline 28 \end{array}$

Copy and complete the patterns.

23. 8, 16, 24, 32, 40, 48, 56, 64, 72

24. 9, 18, 27, 36, 45, 54, 63, 72, 81

Copy and complete the tables.

25.

Number of rows	6	5	2	9	?	?	3	?
Seeds in each row	9	8	9	?	7	2	?	9
Seeds in all		?	?	36	56	18	27	72

26.

$\times 8$
1 8
2 16
3 24
4 32
5 40
6 48
7 56
8 64
9 72

27.

$\times 9$
1 9
2 18
3 27
4 36
5 45
6 54
7 63
8 72
9 81

Solve.

28. 8 rows.
4 seeds in each row.
How many seeds in all? 32
29. 4 rows.
9 seeds in each row.
How many seeds in all? 36
30. 9 rows.
5 seeds in each row.
How many seeds in all? 45
31. 35 seeds.
The same number of seeds in each row.
How many rows? 7 rows,
How many seeds in each row? 5 seeds in each or 5 rows, 7 seeds in each.

RELATED ACTIVITIES

- The first three activities on page T 298 may be adapted for multiples of 9.
- Have the children write the multiples of 9 in sequence in a column. Help the children find patterns in the multiples of 9 to 9×9 . For example, the sum of the digits for each multiple of 9, except 0, is 9 ($9 \times 2 = 18$, $1 + 8 = 9$). The first digit in each multiple of 9 from 18 to 90 is one less than the first digit in the preceding multiple. Children may enjoy the challenge of discovering other patterns.
- Have children repeat the third activity described on page T 36, using a ten-by-ten section of graph paper from copies of page T 360. Have them ring only the last letter of their name each time and write the corresponding number sequence for that letter.
- Show a nine-by-nine array of dots on an overhead transparency. Give children copies of the array cut from copies of page T 366. Name pairs of numbers. Have children use two cards on their arrays to find the products. Show answers using two cards on the transparency.
- Have children work in pairs with one nine-by-nine array of dots and two cards. One child uses the cards to cover part of the array to form a new array. The other child writes the corresponding multiplication sentence. Then the roles are reversed.



Exercises: The exercises involve products having 7, 8, or 9 as a factor. Ex. 31 is starred because there are two correct answers, seven rows with five seeds in each row or five rows with seven seeds in each row.

Assessment

Multiply.

1. 9×3 27 2. 7×9 63 3. 9×9 81

4. $\begin{array}{r} 9 \\ \times 4 \\ \hline 36 \end{array}$ 5. $\begin{array}{r} 8 \\ \times 9 \\ \hline 72 \end{array}$ 6. $\begin{array}{r} 5 \\ \times 9 \\ \hline 45 \end{array}$

Solve.

- 6 rows.
9 seeds in each row.
How many seeds in all? 54

OBJECTIVE

Demonstrate competence in completing basic multiplication facts; solve related word problems.

Materials

an overhead projector and a transparency showing a copy of the multiplication table on page 276 (optional), two blank cards for each child

Practice

This table shows the 100 basic multiplication facts.

×	0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9
2	0	2	4	6	8	10	12	14	16	18
3	0	3	6	9	12	15	18	21	24	27
4	0	4	8	12	16	20	24	28	32	36
5	0	5	10	15	20	25	30	35	40	45
6	0	6	12	18	24	30	36	42	48	54
7	0	7	14	21	28	35	42	49	56	63
8	0	8	16	24	32	40	48	56	64	72
9	0	9	18	27	36	45	54	63	72	81

Use it like this to find 5×4 .

×		4
5		20

The table shows $5 \times 4 = 20$.

Exercises

Multiply. Use the table if you need to.

1. 4×5 20
2. 5×2 10
3. 9×9 81
4. 3×4 12
5. 5×9 45
6. 8×7 56
7. 7×3 21
8. 5×0 0
9. 2×6 12
10. 7×2 14

Multiply.

11. $\begin{array}{r} 7 \\ \times 5 \\ \hline 35 \end{array}$
12. $\begin{array}{r} 5 \\ \times 3 \\ \hline 15 \end{array}$
13. $\begin{array}{r} 6 \\ \times 6 \\ \hline 36 \end{array}$
14. $\begin{array}{r} 8 \\ \times 5 \\ \hline 40 \end{array}$
15. $\begin{array}{r} 6 \\ \times 8 \\ \hline 48 \end{array}$
16. $\begin{array}{r} 7 \\ \times 9 \\ \hline 63 \end{array}$
17. $\begin{array}{r} 4 \\ \times 8 \\ \hline 32 \end{array}$
18. $\begin{array}{r} 5 \\ \times 7 \\ \hline 35 \end{array}$
19. $\begin{array}{r} 8 \\ \times 9 \\ \hline 72 \end{array}$
20. $\begin{array}{r} 8 \\ \times 0 \\ \hline 0 \end{array}$
21. $\begin{array}{r} 7 \\ \times 3 \\ \hline 21 \end{array}$
22. $\begin{array}{r} 9 \\ \times 3 \\ \hline 27 \end{array}$
23. $\begin{array}{r} 2 \\ \times 8 \\ \hline 16 \end{array}$
24. $\begin{array}{r} 9 \\ \times 7 \\ \hline 63 \end{array}$
25. $\begin{array}{r} 6 \\ \times 5 \\ \hline 30 \end{array}$
26. $\begin{array}{r} 8 \\ \times 8 \\ \hline 64 \end{array}$
27. $\begin{array}{r} 8 \\ \times 1 \\ \hline 8 \end{array}$
28. $\begin{array}{r} 7 \\ \times 6 \\ \hline 42 \end{array}$

Write $<$, $>$, or $=$ to complete each sentence.

29. 6×3 \odot 6×4 $<$
30. 8×5 \odot 6×5 $>$
31. 4×8 \odot 4×9 $<$
32. 4×7 \odot 7×4 $=$
33. 8×3 \odot 9×2 $>$
34. 7×7 \odot 6×8 $>$
35. 4×6 \odot 3×8 $=$
36. 9×6 \odot 7×8 $<$
37. 7×6 \odot 9×5 $<$

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LESSON ACTIVITY

Using the Pages

- The basic multiplication facts are summarized in a table which can help children master the facts. Explain that the factors 0 to 9 are shown down the left column and across the top row. Point out that the remaining numbers show products. Discuss the example that shows 5×4 . Emphasize that the first factor is chosen from the left column and the second factor from the top row.

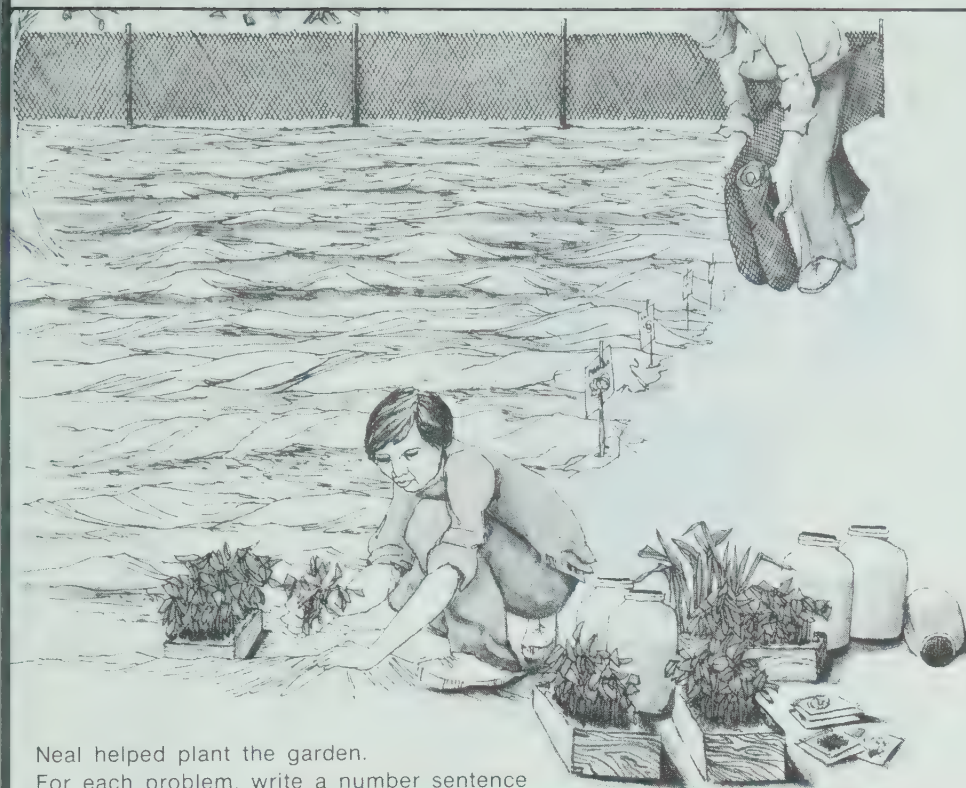
Have each child show 5×4 by placing two cards on the multiplication table. Have them place one card along the line under the row for 5 as a factor and the second card along the line to the right of the column for 4 as a factor. The product is shown where the two cards meet. Have the children use cards on the table to find 5×5 , 5×7 , 5×8 , 7×5 , and 8×5 . Use other examples as needed. (It would be helpful to have a copy of the multiplication table on an overhead transparency. The children can check their work as you show each example using the overhead

projector. If a projector is not available, prepare a large table on chart paper and use an L-shaped cardboard guide to indicate the factors and product.)

Have the children place one card along the line under the row for zero as a factor. Discuss why each product in that row is zero. Have the children move their cards down the table one row at a time and observe the pattern of numbers for each row. You may adapt the procedure to have them observe the pattern of numbers for each column, one column at a time.

Exercises: You may wish to have the children first complete the exercises for which they know the facts. Then have them complete the remaining exercises with the help of the table.

Ex. 38 uses the symbol d for days and h for hours. Ex. 45 is starred because it involves addition, not multiplication. This exercise may help you determine whether children have read the word problem carefully before solving it.



Neal helped plant the garden.

For each problem, write a number sentence and answer the question. *The number sentences with the factors or the addends in the opposite order are acceptable.*

38. 8 d (days) to plant. 3 h (hours) of work each day. $8 \times 3 = 24$
How many hours worked in all? 24
40. 4 boxes of tomato plants. 6 plants in each box. How $4 \times 6 = 24$
many tomato plants in all? 24
42. 5 bottles to carry water. 8 l in each bottle. $5 \times 8 = 40$
How much water in all? 40 L
44. 3 types of potatoes. 4 rows of each type. How many rows of potatoes in all? $3 \times 4 = 12$
 12
39. 2 rows of cabbages. 9 cabbages in each row. $2 \times 9 = 18$
How many cabbages in all? 18
41. 6 hills for pumpkins. 9 pumpkin seeds in each hill. $6 \times 9 = 54$
How many pumpkin seeds in all? 54
43. 4 sides to fence. 6 m on each side. How much $4 \times 6 = 24$
fencing in all? 24 m
- *45. 7 rows of sweet corn. 3 rows of popcorn. How many rows of corn in all? $7 + 3 = 10$
 10

277

RELATED ACTIVITIES

- Give each child a copy of page T 360. Have them make a multiplication table similar to the one on page 276 for exploring patterns as follows. Have the children color the squares for the following products blue: 0×0 , 1×1 , 2×2 , . . . , 9×9 . These squares will form one diagonal of the table. This diagonal acts as a "mirror" in the table, dividing it into two parts in which the numerals are arranged symmetrically. Children can observe this by coloring the squares for the products for a sequence of factors such as the following: 0×6 , 6×0 , 1×5 , 5×1 , 2×4 , 4×2 , 3×3 ; or 9×7 , 8×7 , 7×7 , 7×8 , 7×9 . Encourage children to find other number patterns in the table and then color the squares to show the patterns. Have them keep the copies of the table for reference in work with multiplication and division.

- Have children play the game "Match Up" described on page T 349. A set of matching cards would consist of two "factor" cards and one "product" card such as the following.

7	9	63
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LESSON OUTCOME

Multiplying a multiple of ten by a one-digit number

Materials

models for hundreds and tens

Vocabulary

multiple

Prerequisite Skills

Complete basic multiplication facts; express a multiple of ten as the number of tens

Checking Prerequisite Skills

Multiply.

1. 3×4 **12** 2. 5×3 **15**

3. 6×8 **48** 4. 9×7 **63**

5. 2×6 **12** 6. 7×5 **35**

Complete each of the following.

7. 4 tens = 40

8. 7 tens = 70

9. 10 tens = 100

10. 15 tens = 150

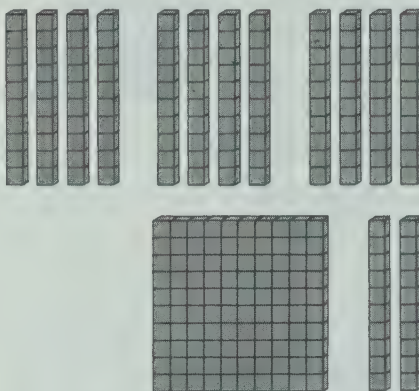
11. 28 tens = 280

12. 54 tens = 540

10 and Multiples of 10 as Factors

What is the product of 3 and 40?

For 3×40 , think of 3 groups of 40
or 3 groups of 4 tens.



$3 \times 4 = 12$

3×4 tens = 12 tens

$3 \times 40 = 120$

The product of 3 and 40 is 120.

Take another look:

4 tens	40
$\times 3$	$\times 3$
12 tens	120

Working Together

Complete.

1. $3 \times 3 =$ **9**

2. $6 \times 1 =$ **6**

3. $5 \times 3 =$ **15**

3×3 tens = tens **9** 6×1 ten = tens **6** 5×3 tens = tens **15**

$3 \times 30 =$ **90** $6 \times 10 =$ **60** $5 \times 30 =$ **150**

4. $2 \times 30 =$ **60** 5. $9 \times 10 =$ **90** 6. $7 \times 40 =$ **280**

Multiply.

7. $\begin{array}{r} 20 \\ \times 3 \\ \hline 60 \end{array}$

8. $\begin{array}{r} 60 \\ \times 9 \\ \hline 540 \end{array}$

9. $\begin{array}{r} 10 \\ \times 4 \\ \hline 40 \end{array}$

10. $\begin{array}{r} 50 \\ \times 2 \\ \hline 100 \end{array}$

11. $\begin{array}{r} 90 \\ \times 6 \\ \hline 540 \end{array}$

12. $\begin{array}{r} 40 \\ \times 5 \\ \hline 200 \end{array}$

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LESSON ACTIVITY

Before Using the Pages

- Display 4 groups of 2 tens. Ask:
“How many groups of tens are there?”
“How many tens are in each group?”
“How many tens are there in all?”
“What number is named by eight tens?”

Display 3 groups of 5 tens. Ask the first three questions suggested above. Then lead the children to suggest regrouping 10 tens as 1 hundred. Have a child replace the models for 10 of the 15 tens with a model for 1 hundred.

Then ask:

- “How many hundreds are there?”
- “How many tens are there?”
- “What number is named by one hundred and five tens?”

Using the Pages

- Draw the children’s attention to the word *multiples* at the top of page 278. Explain that 10, 20, 30, . . . are called multiples of ten. Ask questions such as,
“What is the next multiple of ten after forty?”
“Is ninety a multiple of ten?”
“Is ninety-five a multiple of ten?”
Have the children explain the reasons for their answers.
- Guide the children through the worked example by asking them questions such as,
“What does 3×40 mean?”
“What does the 4 in 40 represent?”
“What is another way to think of 3 groups of 40?”
“How many tens is 3×4 tens?”
Have the children point to the picture of 12 tens and explain how they can be regrouped. Ask them to give the standard name and numeral for 12 tens.

You may wish to have the children review the procedure illustrated on the page, using their own models for hundreds and tens. Draw the children’s attention to the two

Exercises

Multiply.

1. 6×20 120
2. 3×70 210
3. 2×20 40
4. 6×40 240
5. 4×80 320
6. 4×30 120
7. 1×70 70
8. 5×10 50
9. 9×30 270
10. 8×90 720

Multiply.

11. $\begin{array}{r} 70 \\ \times 5 \\ \hline 350 \end{array}$
12. $\begin{array}{r} 80 \\ \times 7 \\ \hline 560 \end{array}$
13. $\begin{array}{r} 50 \\ \times 3 \\ \hline 150 \end{array}$
14. $\begin{array}{r} 60 \\ \times 4 \\ \hline 240 \end{array}$
15. $\begin{array}{r} 70 \\ \times 2 \\ \hline 140 \end{array}$
16. $\begin{array}{r} 90 \\ \times 4 \\ \hline 360 \end{array}$
17. $\begin{array}{r} 70 \\ \times 7 \\ \hline 490 \end{array}$
18. $\begin{array}{r} 50 \\ \times 6 \\ \hline 300 \end{array}$
19. $\begin{array}{r} 40 \\ \times 2 \\ \hline 80 \end{array}$

Copy and complete the tables.

20. $\begin{array}{r|l} \times & 80 \\ \hline 6 & 480 \\ 8 & 640 \\ 3 & 240 \\ 5 & 400 \\ 0 & 0 \\ 2 & 160 \end{array}$
21. $\begin{array}{r|l} \times & 50 \\ \hline 5 & 250 \\ 9 & 450 \\ 1 & 50 \\ 4 & 200 \\ 7 & 350 \\ 8 & 400 \end{array}$

Solve.

22. 60 s (seconds) in each minute. How many seconds in 5 min (minutes)? 300
23. How many seconds in 8 min? 480
24. 60 min in each hour. How many minutes in 3 h (hours)? 180
25. How many minutes in 7 h? 420

There are just 4 bags left that hold 30 kg.

ORDER

send 150 kg of goods in five bags

~60 kg bags

~50

~40

~30

~20

Different combinations are possible. Two are given.

Choose 5 bags to fill the order.

two 60 kg bags
one 30 kg bag
or
three 50 kg bags

PROBLEM SOLVING

279

RELATED ACTIVITIES

- Some children may benefit from completing pairs of exercises similar to the following.

$$\begin{array}{r} 4 \text{ tens} \quad 40 \\ \times \quad 2 \\ \hline 8 \text{ tens} \quad 80 \end{array}$$

- Further practice with tables similar to Ex. 20 and 21 may be helpful. Two are shown here. (Copies of page T 367 may be used.)

\times	70
1	
8	
3	
0	

\times	40
7	
9	
4	
1	

- Have children play the game "Checkers" with the following variation. Each checker of one color is marked to show a one-digit number. Each checker of the other color is marked to show a multiple of ten, to 90. The game is played in the usual way except that in order to complete a capture, a player must name the product of the numbers shown on the two checkers involved.
- Adapt the game "A Number To Go" described on page T41 for multiplication. Use four sets of numeral cards for 0 to 9.
- The game "Check Off" described on page T350 and adapted on page T171 may now be played to include all the basic multiplication facts.

exercises in vertical form. Review that knowing $3 \times 4 = 12$ helps in finding 3×40 since 40 is 4 tens. Ask the children what multiplication fact would help in finding 3×30 .

Working Together: Ex. 1 develops the concept that knowing 3×3 helps in finding 3×30 . Ex. 2 and 3 are similar to Ex. 1. Use other exercises similar to these as needed, before the children proceed with the remaining exercises. Have children show their work on the board and explain the exercises in terms of basic multiplication facts.

Exercises: You may need to review how the tables are completed for Ex. 20 and 21. Ex. 22-25 review the symbols s for seconds, min for minutes, and h for hours.

Problem Solving: Point out that the problem would be easier to solve if there were five bags that held 30 kg because the product of 5 and 30 is 150. However, since there are only four bags that hold 30 kg, the children must find another way to send 150 kg in five bags. The children will likely solve the problem through a process of trial and error.

When the solution is discussed, it will probably become evident that there is more than one way to fill the order.

For less capable children you may wish to present a similar problem that involves simpler numbers. The bags would hold 2 kg, 3 kg, 4 kg, 5 kg, and 6 kg, and there would be only four bags that hold 3 kg.

Assessment

Multiply.

1. 4×20 80
2. 3×80 240
3. $\begin{array}{r} 50 \\ \times 6 \\ \hline 300 \end{array}$
4. $\begin{array}{r} 90 \\ \times 9 \\ \hline 810 \end{array}$

LESSON OUTCOME

Multiply a two-digit number by a one-digit number, no regrouping

Materials

dimes and pennies or models for tens and ones (optional)

Prerequisite Skills

Complete basic multiplication facts; find the product of a one-digit number and a multiple of ten

Checking Prerequisite Skills

Multiply.

1.
$$\begin{array}{r} 9 \\ \times 1 \\ \hline 9 \end{array}$$
2.
$$\begin{array}{r} 4 \\ \times 2 \\ \hline 8 \end{array}$$
3.
$$\begin{array}{r} 3 \\ \times 3 \\ \hline 9 \end{array}$$
4.
$$\begin{array}{r} 0 \\ \times 2 \\ \hline 0 \end{array}$$
5.
$$\begin{array}{r} 40 \\ \times 2 \\ \hline 80 \end{array}$$
6.
$$\begin{array}{r} 50 \\ \times 5 \\ \hline 250 \end{array}$$

Multiplying with No Regrouping

Emily sold green beans from her garden for 32¢ a bag. How much did she get for 3 bags of green beans?

Multiply 3×32 .

Multiply 3×2 ones.

3×2 ones = 6 ones.

Multiply 3×3 tens or 3×30 .

3×3 tens = 9 tens.
 $3 \times 30 = 90$

Add 6 and 90.

Emily got 96¢ for 3 bags of green beans.

280



$$\begin{array}{r} \text{tens} \quad \text{ones} \\ 32 \\ \times 3 \\ \hline 6 \end{array}$$



$$\begin{array}{r} \text{tens} \quad \text{ones} \\ 32 \\ \times 3 \\ \hline 6 \\ 90 \end{array}$$



$$\begin{array}{r} \text{tens} \quad \text{ones} \\ 32 \\ \times 3 \\ \hline 6 \\ 90 \\ \hline 96 \end{array}$$



LESSON ACTIVITY

Before Using the Pages

- Review that 3×3 means 3 groups of 3 and 3×30 means 3 groups of 30. Ask about the meaning of 3×32 . Lead the children to suggest that 3×32 means 3 groups of 32.

Using the Pages

- Read the problem for the worked example. Establish that the answer can be found by multiplying 3 and 32 because the problem concerns 3 groups of 32 (cents). Remind the children that knowing the basic fact $3 \times 3 = 9$ helps in finding 3×30 . Ask what basic facts would be helpful in finding 3×32 .

The worked example highlights each step of the procedure of multiplying 3 and 32 in red. Groups of coins are shown to correspond to each step. Guide the children through the example, asking questions similar to the following.

“What is multiplied first?”

“What coins show this?”

“What is multiplied next?”

“What coins show this?”

“What coins are shown in the last picture?”

“How much money is this?”

Then relate the amount 96¢ to the sum of the addends 90 and 6 in the exercise.

Working Together: Ex. 1 and 2 establish the three steps in the procedure of obtaining the product. Discuss each step for Ex. 1 and 2. Emphasize that the ones are multiplied first and then the tens. Point out that the product of 3 and 21 is obtained by knowing the basic facts $3 \times 1 = 3$ and $3 \times 2 = 6$.

Have the children complete similar exercises as needed. Children may show their work on the board and explain the steps. Some children may need to use models for tens and ones.

Working Together

Follow the steps.

- $$\begin{array}{r} 21 \\ \times 3 \\ \hline 63 \end{array}$$

Multiply 3×1 . \longrightarrow 3
 Multiply 3×2 tens. \longrightarrow 60
 Add to get \longrightarrow 63
- $$\begin{array}{r} 34 \\ \times 2 \\ \hline 68 \end{array}$$

Multiply 2×4 . \longrightarrow 8
 Multiply 2×3 tens. \longrightarrow 60
 Add to get \longrightarrow 68

Multiply.

- $$\begin{array}{r} 33 \\ \times 2 \\ \hline 66 \end{array}$$
- $$\begin{array}{r} 31 \\ \times 3 \\ \hline 93 \end{array}$$
- $$\begin{array}{r} 21 \\ \times 4 \\ \hline 84 \end{array}$$
- $$\begin{array}{r} 30 \\ \times 3 \\ \hline 90 \end{array}$$

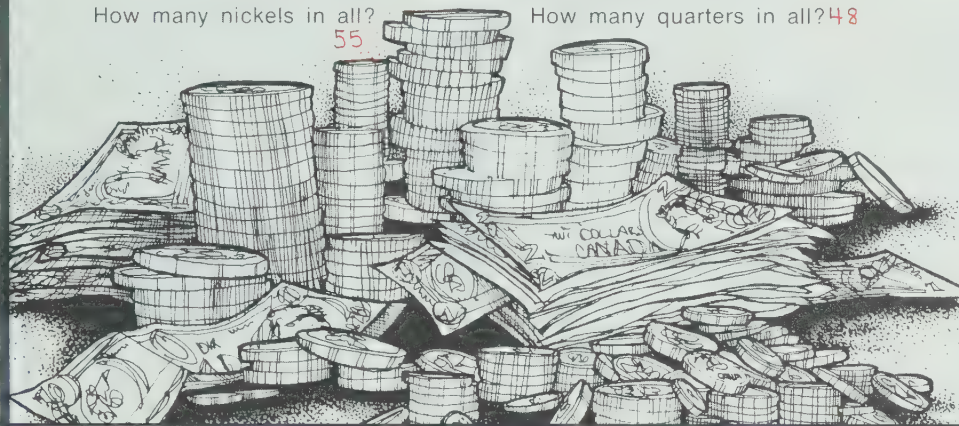
Exercises

Multiply.

- $$\begin{array}{r} 22 \\ \times 4 \\ \hline 88 \end{array}$$
- $$\begin{array}{r} 23 \\ \times 2 \\ \hline 46 \end{array}$$
- $$\begin{array}{r} 12 \\ \times 3 \\ \hline 36 \end{array}$$
- $$\begin{array}{r} 44 \\ \times 2 \\ \hline 88 \end{array}$$
- $$\begin{array}{r} 21 \\ \times 2 \\ \hline 42 \end{array}$$
- $$\begin{array}{r} 13 \\ \times 3 \\ \hline 39 \end{array}$$
- $$\begin{array}{r} 10 \\ \times 5 \\ \hline 50 \end{array}$$
- $$\begin{array}{r} 32 \\ \times 2 \\ \hline 64 \end{array}$$
- $$\begin{array}{r} 33 \\ \times 3 \\ \hline 99 \end{array}$$
- $$\begin{array}{r} 41 \\ \times 2 \\ \hline 82 \end{array}$$
- $$\begin{array}{r} 20 \\ \times 4 \\ \hline 80 \end{array}$$
- $$\begin{array}{r} 13 \\ \times 2 \\ \hline 26 \end{array}$$
- $$\begin{array}{r} 11 \\ \times 4 \\ \hline 44 \end{array}$$
- $$\begin{array}{r} 23 \\ \times 3 \\ \hline 69 \end{array}$$
- $$\begin{array}{r} 42 \\ \times 2 \\ \hline 84 \end{array}$$

Solve.

- 11 quarters.
5 nickels for each quarter.
How many nickels in all? **55**
- 12 dollars.
4 quarters for each dollar.
How many quarters in all? **48**



Exercises: Although some children may be able to write products without showing the partial products in the solutions, tell them to show all the steps at this stage. This will help them understand the lesson involving multiplication with regrouping on page 282.

Assessment

Multiply.

- $$\begin{array}{r} 34 \\ \times 2 \\ \hline 68 \end{array}$$
- $$\begin{array}{r} 41 \\ \times 5 \\ \hline 205 \end{array}$$
- $$\begin{array}{r} 12 \\ \times 4 \\ \hline 48 \end{array}$$
- $$\begin{array}{r} 31 \\ \times 3 \\ \hline 93 \end{array}$$

Solve.

- 42 dimes.
2 nickels for each dime.
How many nickels? **84**

RELATED ACTIVITIES

• Some children may benefit from showing exercises in a place-value chart and drawing diagrams to illustrate exercises. (Copies of page T361 may be used.)

tens	ones	
2	1	
\times	4	
	4	
8	0	
8	4	

• To emphasize that the order of multiplying two numbers does not affect the product, children may work in pairs and complete a blank multiplication table using two different colors. First, a diagonal line segment is drawn through the squares for the products $0 \times 0, 1 \times 1, \dots, 9 \times 9$. (See page T305.) Each child is assigned the squares on one side of this line. One child names two different factors, such as 3 and 4. Each child writes the product in the corresponding square for her/his side of the line and states the multiplication fact ($3 \times 4 = 12$ or $4 \times 3 = 12$). Then the other child states two different factors and the procedure continues. The completed table will display the two identical parts in different colors.

LESSON OUTCOME

Multiply a two-digit number by a one-digit number, with regrouping

Prerequisite Skills

Complete basic multiplication facts; multiply a multiple of ten by a one-digit number; add numbers having one, two, or three digits with zero in the ones' place for one of the numbers

Checking Prerequisite Skills

Multiply.

$$\begin{array}{r} 1. \quad 4 \\ \times 7 \\ \hline 28 \end{array} \quad \begin{array}{r} 2. \quad 8 \\ \times 8 \\ \hline 64 \end{array} \quad \begin{array}{r} 3. \quad 5 \\ \times 6 \\ \hline 30 \end{array}$$

$$\begin{array}{r} 4. \quad 3 \\ \times 9 \\ \hline 27 \end{array} \quad \begin{array}{r} 5. \quad 40 \\ \times 6 \\ \hline 240 \end{array} \quad \begin{array}{r} 6. \quad 80 \\ \times 7 \\ \hline 560 \end{array}$$

Add.

$$\begin{array}{r} 7. \quad 24 \\ + 80 \\ \hline 104 \end{array} \quad \begin{array}{r} 8. \quad 14 \\ + 350 \\ \hline 364 \end{array} \quad \begin{array}{r} 9. \quad 5 \\ + 400 \\ \hline 405 \end{array}$$

Multiplying with Regrouping

Find the product of 2 and 36.

To multiply 36 think of 2 groups of 36.

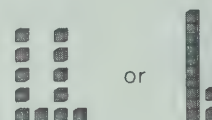
$$\begin{array}{r} 36 \\ \times 2 \\ \hline \end{array}$$



Multiply 2×6 ones.

2×6 ones = 12 ones,
or 1 ten, 2 ones.

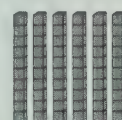
$$\begin{array}{r} \text{tens} \quad \text{ones} \\ 36 \\ \times 2 \\ \hline 12 \end{array}$$



Multiply 2×3 tens
or 2×30 .

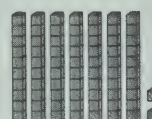
2×3 tens = 6 tens.
 $2 \times 30 = 60$

$$\begin{array}{r} 36 \\ \times 2 \\ \hline 12 \\ 60 \end{array}$$



Add 12 and 60.

$$\begin{array}{r} 36 \\ \times 2 \\ \hline 12 \\ 60 \\ \hline 72 \end{array}$$



The product of 2 and 36 is 72.

282

LESSON ACTIVITY

Before Using the Pages

- Review the steps of multiplying a two-digit number by a one-digit number without regrouping. Have children help complete the exercise 2×34 on the board. Remind the children that the ones are multiplied first and then the tens. Use other examples as needed.

Using the Pages

- The red on the numerals draws attention to the main steps of the procedure. Each step is supported by illustrations of models. Discuss each step of the worked example. Develop how 12 ones are regrouped as 1 ten 2 ones. Lead the children to realize that the new ten is added to the 6 tens in the last step. You may wish to have the children compare the worked example on page 280 and the worked example on page 282. Point out that there were no tens to be added with the nine tens on page 280.

Ask why the ones are multiplied first and then the tens. Establish that it is necessary to determine whether 10 ones must be regrouped as 1 ten before multiplying the tens.

Working Together: Ex. 1-3 illustrate three possible situations that occur when multiplying. In Ex. 1, each partial product is a two-digit number, and the sum is a two-digit number. In Ex. 2, the first partial product is a two-digit number and the second one is a three-digit number; the sum is a three-digit number. In Ex. 3, the second partial product is a two-digit number such that regrouping is necessary for the addition of the partial products.

This may help you determine whether children are experiencing difficulty with a particular type of exercise. Provide similar exercises as needed. It is beneficial to have children write exercises at the board and then explain them orally. They may be guided by the steps outlined in Ex. 1-3.

Working Together

Follow the steps.

$$\begin{array}{r} 23 \\ \times 4 \\ \hline \text{Multiply } 4 \times 3. \longrightarrow 12 \\ \text{Multiply } 4 \times 2 \text{ tens.} \longrightarrow 80 \\ \text{Add to get} \longrightarrow 92 \end{array}$$

$$\begin{array}{r} 39 \\ \times 3 \\ \hline \text{Multiply } 3 \times 9. \longrightarrow 27 \\ \text{Multiply } 3 \times 3 \text{ tens.} \longrightarrow 90 \\ \text{Add.} \longrightarrow 117 \end{array}$$

Multiply.

$$\begin{array}{r} 4. \quad 28 \\ \times 2 \\ \hline 56 \end{array} \quad \begin{array}{r} 5. \quad 35 \\ \times 3 \\ \hline 105 \end{array} \quad \begin{array}{r} 6. \quad 78 \\ \times 4 \\ \hline 312 \end{array}$$

Exercises

Multiply.

$$\begin{array}{r} 1. \quad 36 \\ \times 8 \\ \hline 288 \end{array} \quad \begin{array}{r} 2. \quad 53 \\ \times 2 \\ \hline 106 \end{array} \quad \begin{array}{r} 3. \quad 37 \\ \times 7 \\ \hline 259 \end{array}$$

$$\begin{array}{r} 4. \quad 51 \\ \times 6 \\ \hline 306 \end{array} \quad \begin{array}{r} 5. \quad 45 \\ \times 5 \\ \hline 225 \end{array} \quad \begin{array}{r} 6. \quad 14 \\ \times 6 \\ \hline 84 \end{array}$$

$$\begin{array}{r} 7. \quad 92 \\ \times 9 \\ \hline 828 \end{array} \quad \begin{array}{r} 8. \quad 70 \\ \times 4 \\ \hline 280 \end{array} \quad \begin{array}{r} 9. \quad 47 \\ \times 2 \\ \hline 94 \end{array}$$

$$\begin{array}{r} 10. \quad 64 \\ \times 8 \\ \hline 512 \end{array} \quad \begin{array}{r} 11. \quad 77 \\ \times 5 \\ \hline 385 \end{array} \quad \begin{array}{r} 12. \quad 68 \\ \times 9 \\ \hline 612 \end{array}$$

Find the product of each pair of numbers.

13. 56 and 5 **280** 14. 6 and 65 **390**
15. 74 and 9 **666** 16. 4 and 89 **356**
17. 27 and 4 **108** 18. 7 and 15 **105**

$$\begin{array}{r} 74 \\ \times 3 \\ \hline \text{Multiply } 3 \times 4. \longrightarrow 12 \\ \text{Multiply } 3 \times 7 \text{ tens.} \longrightarrow 210 \\ \text{Add.} \longrightarrow 222 \end{array}$$

The Turners plan to spend \$350 while at their holiday spot. They saw this list in the newspaper.

Travel to	Each day plan to spend about
Banff National Park	\$48
Cape Breton Island	\$33
Florida	\$57
Fundy National Park	\$32
Lake of the Woods	\$34
New York City	\$65
Prince Albert National Park	\$30
Quebec City	\$50
St. Pierre and Miquelon	\$35
Toronto	\$55
Vancouver	\$53

Where could the Turners stay for 7 days for \$350 or less?

PROBLEM SOLVING

RELATED ACTIVITIES

• Children may work in pairs for the following activity. Assign exercises similar to those on pages 282-283. One child finds the product by using models for hundreds, tens, and ones. The other child completes the multiplication exercise on the board or on paper. The two results are compared and any errors are corrected. Then the roles are reversed.

• Two or three children may practice addition and multiplication by playing the following game. Each cup of a plastic egg carton is marked to show a numeral from 0 to 10. Two objects, such as dried beans, are placed in the carton and the lid is closed. Each child, in turn, shakes the carton and then opens it. He/she finds the product of the two numbers determined by the locations of the beans. Each player adds the product he/she obtained in the first round to the product obtained in the second round. This sum is then added to the product obtained in the third round. The player with the greatest sum after ten rounds is the winner.

Exercises: Before the children begin the exercises, review the instructions that precede Ex. 13. Remind them how to write exercises in vertical form with the two-digit number as the upper number and the one-digit number as the multiplier.

Problem Solving: Help the children locate these places on a map of North America. They may enjoy discussing real or imaginative holidays at these places. Explain that the Turners would travel to *one* place and stay there for seven days. Because the problem has more than one solution, you may wish to reduce the amount of work needed. To do this, have the children realize that spending exactly \$50 a day, as for Quebec City, results in an expenditure of exactly \$350 for seven days, and thus, spending more than \$50 a day is not acceptable.

Assessment

Multiply.

$$\begin{array}{r} 23 \\ \times 8 \\ \hline 184 \end{array} \quad \begin{array}{r} 2. \quad 47 \\ \times 5 \\ \hline 235 \end{array} \quad \begin{array}{r} 3. \quad 29 \\ \times 4 \\ \hline 116 \end{array} \quad \begin{array}{r} 4. \quad 46 \\ \times 2 \\ \hline 92 \end{array}$$

OBJECTIVE

Demonstrate competence in multiplying a two-digit number by a one-digit number with or without regrouping; solve related word problems

Practice



Leif lives on a farm.

Use multiplication and answer each question.

1. Leif rides a bus to school. He rides 23 km each day. How far does he ride in 5 d (days)? **115 km**
2. The farm has 3 chicken coops. Leif takes care of 37 chickens in each coop. How many chickens does Leif take care of? **111**
3. Leif planted 4 patches of strawberries. He put 72 plants in each patch. How many plants did he put in? **288**
4. 68 maple trees each have 2 buckets to catch sap in the spring. How many buckets does Leif have to empty when it's his turn to gather the sap? **136**
5. One time Leif gathered 3 l of sap from each of 68 maple trees. How many litres did he gather in all? **204**
6. Leif expects the pigs to have 11 litters of baby pigs this year. He expects about 8 piglets in each litter. About how many piglets does Leif expect in all? **88**

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LESSON ACTIVITY

Using the Pages

- The photograph can be used to motivate a discussion about farming and life on a farm. Encourage the children to share their knowledge and experiences about the way of life on a farm. You may wish to discuss some of the differences between living on a farm and living in a town or city.
- The word problems present situations that could be found on different kinds of farms. If necessary, help children read the problems and write their solutions in an organized manner. You may wish to have a child solve one of the problems on the board. For Ex. 1, the solution would be as follows.

$$\begin{array}{r} 23 \\ \times 5 \\ \hline 15 \\ 100 \\ \hline 115 \end{array}$$


















































Lief rides 115 km in 5 d.

For Ex. 9, remind the children that the symbol L is used for litres now.

Ensure that the children show their work for Ex. 10-14. Note that there is insufficient information to answer Ex. 14 and that any answer is based on speculation.



Leif kept a record of the number of fish he caught each month in the farm pond.

Jan.	
Feb.	
Mar.	   
April	    
May	    
June	       
July	        
Aug.	       
Sept.	    
Oct.	 
Nov.	
Dec.	
Each  = 5 fish caught.	

Leif sold 4 pigs when each pig reached 98 kg. How heavy were the 4 pigs together? **392 kg**

There are 27 cows in each of 3 fields. How many cows are there in all? **81**

One cow gave 36 l of milk each day for 3 d. How much milk did the cow give in the 3 d? **108 L**

10. How many fish did Leif catch in April? **30**
11. How many fish did Leif catch in August? **60**
12. In what month did Leif catch the most fish? **July**
13. How many more fish did Leif catch in September than in October? **20**
- *14. In what month did Leif go fishing the most times? **The answer is not indicated in the record.**

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RELATED ACTIVITIES

- You may wish to have children work in groups to prepare pictographs. Information related to their interests or other subjects may be used. Questions related to the graphs may be prepared for other children to consider.
- Children may enjoy collecting pictures about farms for a display. Each picture should be accompanied by a word problem for other children to solve.
- Have children select numbers for multiplication exercises by tossing three dice, one marked 1, 2, 3, 4, 5, 6, one marked 4, 5, 6, 7, 8, 9, and one marked 1, 2, 3, 7, 8, 9. For example, if the numbers 4, 6, and 9 are shown on the dice, the following exercises may be obtained.

$$\begin{array}{r} 69 \\ \times 4 \\ \hline \end{array}$$

$$\begin{array}{r} 96 \\ \times 4 \\ \hline \end{array}$$

$$\begin{array}{r} 49 \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} 94 \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} 46 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 64 \\ \times 9 \\ \hline \end{array}$$

- The above activity may be adapted for a game for three children. One player tosses the dice. Each player writes one multiplication exercise for the numbers shown on the dice. Points may be awarded as follows: "highest" product, 3; "middle" product, 2; "lowest" product, 1. After ten rounds the player with the most points is the winner.

LESSON OUTCOME

Use the standard algorithm to multiply a two-digit number by a one-digit number

Vocabulary

algorithm, standard form

Prerequisite Skills

Complete basic multiplication facts; add with regrouping

Checking Prerequisite Skills

Multiply.

1. 7×8 56 2. 4×9 36 3. 7×6 42

Add. $36 + 36 = 72$ $87 + 87 = 174$ $49 + 49 = 98$

4. $36 \times 2 = 72$ 5. $87 \times 2 = 174$ 6. $49 \times 2 = 98$

Multiplying with the Standard Algorithm

36 eggs in each box.
How many eggs in 9 boxes?
Multiply 9×36 .

Multiply 9×6 ones.

9×6 ones = 54 ones
or 5 tens, 4 ones.

Save the 5 tens.

Multiply 9×3 tens.

9×3 tens = 27 tens.

Add the 5 tens
that were saved.

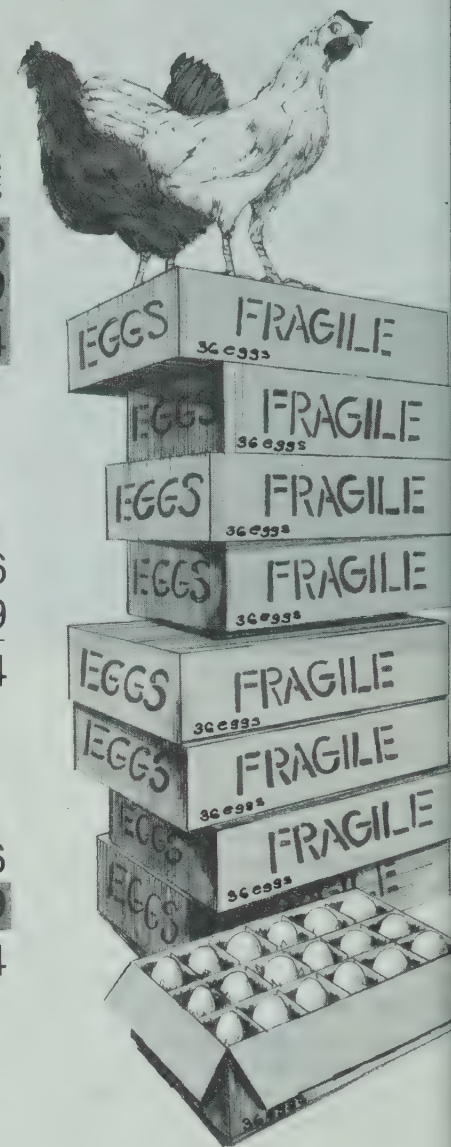
5 more tens make 32 tens
or 3 hundreds, 2 tens.

This **standard form** for multiplying
shows there are 324 eggs in 9 boxes.

$$\begin{array}{r} \text{tens} \quad \text{ones} \\ 36 \\ \times 9 \\ \hline 54 \end{array}$$

$$\begin{array}{r} 5 \\ 36 \\ \times 9 \\ \hline 4 \end{array}$$

$$\begin{array}{r} 5 \\ 36 \\ \times 9 \\ \hline 324 \end{array}$$



LESSON ACTIVITY

Before Using the Pages

- Write the exercise 9×36 on the board in vertical form. Have the children copy and complete the exercise. Have one child show the exercise on the board and explain each step of the procedure.

$$\begin{array}{r} 36 \\ \times 9 \\ \hline 54 \\ 270 \\ \hline 324 \end{array}$$

Explain that the amount of written work required to arrive at the product 324 can be reduced if the regrouping is shown in a shorter way.

Using the Pages

- Read the statement to introduce the word problem. Discuss that multiplication can be used to solve the problem because the situation involves 9 groups of 36. Ask the following questions about the worked example.
 - “What is the product of nine and six ones?”
 - “How many tens and ones is this?”
 - “What does ‘Save the five tens’ mean?”
 - “What is the product of nine and three tens?”
 - “Why does the product show thirty-two tens rather than twenty-seven tens?”
 - “How many hundreds and tens is thirty-two tens?”
 - “What is the product of nine and thirty-six?”

Point out the word *Algorithm* at the top of page 286 and the words *standard form* at the bottom of the page. Tell the children that these terms have the same meaning. Explain that the standard form for multiplying shows the regrouping in a shorter way. Show 9×36 on the board in the standard form beside the exercise developed during *Before Using the Pages*.

Working Together

Show each multiplication in the standard form.

Example: 38×6 becomes 38×6

$$\begin{array}{r} 38 \\ \times 6 \\ \hline 48 \\ 180 \\ \hline 228 \end{array}$$

1. 27×3 2. 54×9 3. 25×6 4. 67×8

$$\begin{array}{r} 27 \\ \times 3 \\ \hline 81 \end{array}$$

$$\begin{array}{r} 54 \\ \times 9 \\ \hline 486 \end{array}$$

$$\begin{array}{r} 25 \\ \times 6 \\ \hline 150 \end{array}$$

$$\begin{array}{r} 67 \\ \times 8 \\ \hline 536 \end{array}$$

Multiply. Use the standard form.

5. 24×4 6. 38×3 7. 59×6 8. 77×8 9. 46×5

$$\begin{array}{r} 24 \\ \times 4 \\ \hline 96 \end{array}$$

$$\begin{array}{r} 38 \\ \times 3 \\ \hline 114 \end{array}$$

$$\begin{array}{r} 59 \\ \times 6 \\ \hline 354 \end{array}$$

$$\begin{array}{r} 77 \\ \times 8 \\ \hline 616 \end{array}$$

$$\begin{array}{r} 46 \\ \times 5 \\ \hline 230 \end{array}$$

Exercises

Multiply. Use the standard form.

1. 36×4 2. 42×8 3. 57×3 4. 26×8 5. 52×7 6. 49×9

$$\begin{array}{r} 36 \\ \times 4 \\ \hline 144 \end{array}$$

$$\begin{array}{r} 42 \\ \times 8 \\ \hline 336 \end{array}$$

$$\begin{array}{r} 57 \\ \times 3 \\ \hline 171 \end{array}$$

$$\begin{array}{r} 26 \\ \times 8 \\ \hline 208 \end{array}$$

$$\begin{array}{r} 52 \\ \times 7 \\ \hline 364 \end{array}$$

$$\begin{array}{r} 49 \\ \times 9 \\ \hline 441 \end{array}$$

7. 27×8 8. 66×6 9. 75×4 10. 39×7 11. 17×4 12. 28×6

$$\begin{array}{r} 27 \\ \times 8 \\ \hline 216 \end{array}$$

$$\begin{array}{r} 66 \\ \times 6 \\ \hline 396 \end{array}$$

$$\begin{array}{r} 75 \\ \times 4 \\ \hline 300 \end{array}$$

$$\begin{array}{r} 39 \\ \times 7 \\ \hline 273 \end{array}$$

$$\begin{array}{r} 17 \\ \times 4 \\ \hline 68 \end{array}$$

$$\begin{array}{r} 28 \\ \times 6 \\ \hline 168 \end{array}$$

There are 12 in a dozen. Complete this table.

13.	Number of dozen	1	2	3	4	5	6	7	8	9
	Number in all	12	24	36	48	60	72	84	96	108

What would the calculator show for each product?

14. 7×84 15. 9×35

$$\begin{array}{r} \times \\ \hline 588 \end{array}$$

$$\begin{array}{r} \times \\ \hline 315 \end{array}$$

RELATED ACTIVITIES

- Have children complete exercises from previous lessons using the standard algorithm.
- Have children name objects that are frequently sold by the dozen. Challenge children with questions similar to the following. "How many eggs are in two and one-half dozen eggs?"
- It is important that children remember that multiplication is a short way of performing repeated addition. Exercises of the following type would be beneficial.

How many seventy-fours?
What is the sum?

$$\begin{array}{r} 74 \\ 74 \\ 74 \\ 74 \\ 74 \\ + 74 \\ \hline \end{array}$$

What is the product?

$$\begin{array}{r} 74 \\ \times 5 \\ \hline \end{array}$$

- Cut pieces of squared paper into rectangular sections such as eight squares by nineteen squares. (Copies of page T365 may be used.) Have children use multiplication to find the number of squares in each section.

Working Together: Compare the two solutions of the example. Point out how the written work is reduced by saving the 4 tens at the top of the tens' column, and by computing $(6 \times 3 \text{ tens}) + 4 \text{ tens}$ mentally. Have the children multiply for Ex. 1-4 using the standard form and then check their answers with those on the page. Have children show solutions on the board for Ex. 5-9. Discuss difficulties that arise. Use similar examples, if necessary.

Exercises: Children may need help in reading the numerals for Ex. 14 (7×84) and Ex. 15 (9×35).

Assessment

Multiply. Use the standard form.

1. 24×5 2. 38×2 3. 49×8 4. 92×7

$$\begin{array}{r} 24 \\ \times 5 \\ \hline 120 \end{array}$$

$$\begin{array}{r} 38 \\ \times 2 \\ \hline 76 \end{array}$$

$$\begin{array}{r} 49 \\ \times 8 \\ \hline 392 \end{array}$$

$$\begin{array}{r} 92 \\ \times 7 \\ \hline 644 \end{array}$$

OBJECTIVE

Demonstrate competence in multiplying a two-digit number by a one-digit number with or without regrouping; solve related word problems



Practice

Multiply.

- | | | |
|---|---|---|
| 1. $\begin{array}{r} 33 \\ \times 9 \\ \hline 297 \end{array}$ | 2. $\begin{array}{r} 68 \\ \times 6 \\ \hline 408 \end{array}$ | 3. $\begin{array}{r} 44 \\ \times 4 \\ \hline 176 \end{array}$ |
| 4. $\begin{array}{r} 72 \\ \times 2 \\ \hline 144 \end{array}$ | 5. $\begin{array}{r} 87 \\ \times 2 \\ \hline 174 \end{array}$ | 6. $\begin{array}{r} 59 \\ \times 4 \\ \hline 236 \end{array}$ |
| 7. $\begin{array}{r} 53 \\ \times 3 \\ \hline 159 \end{array}$ | 8. $\begin{array}{r} 27 \\ \times 7 \\ \hline 189 \end{array}$ | 9. $\begin{array}{r} 69 \\ \times 5 \\ \hline 345 \end{array}$ |
| 10. $\begin{array}{r} 82 \\ \times 7 \\ \hline 574 \end{array}$ | 11. $\begin{array}{r} 93 \\ \times 4 \\ \hline 372 \end{array}$ | 12. $\begin{array}{r} 47 \\ \times 9 \\ \hline 423 \end{array}$ |
| 13. $\begin{array}{r} 29 \\ \times 8 \\ \hline 232 \end{array}$ | 14. $\begin{array}{r} 56 \\ \times 7 \\ \hline 392 \end{array}$ | 15. $\begin{array}{r} 81 \\ \times 4 \\ \hline 324 \end{array}$ |
| 16. $\begin{array}{r} 43 \\ \times 8 \\ \hline 344 \end{array}$ | 17. $\begin{array}{r} 25 \\ \times 5 \\ \hline 125 \end{array}$ | 18. $\begin{array}{r} 64 \\ \times 9 \\ \hline 576 \end{array}$ |
| 19. $\begin{array}{r} 18 \\ \times 8 \\ \hline 144 \end{array}$ | 20. $\begin{array}{r} 97 \\ \times 2 \\ \hline 194 \end{array}$ | 21. $\begin{array}{r} 88 \\ \times 6 \\ \hline 528 \end{array}$ |
| 22. $\begin{array}{r} 58 \\ \times 9 \\ \hline 522 \end{array}$ | 23. $\begin{array}{r} 35 \\ \times 3 \\ \hline 105 \end{array}$ | 24. $\begin{array}{r} 46 \\ \times 5 \\ \hline 230 \end{array}$ |
| 25. $\begin{array}{r} 75 \\ \times 3 \\ \hline 225 \end{array}$ | 26. $\begin{array}{r} 23 \\ \times 6 \\ \hline 138 \end{array}$ | 27. $\begin{array}{r} 76 \\ \times 8 \\ \hline 608 \end{array}$ |
| 28. $\begin{array}{r} 51 \\ \times 5 \\ \hline 255 \end{array}$ | 29. $\begin{array}{r} 49 \\ \times 6 \\ \hline 294 \end{array}$ | 30. $\begin{array}{r} 66 \\ \times 3 \\ \hline 198 \end{array}$ |

The Town Market is open every Saturday. Use multiplication and answer each question.

31. Mrs. Souza sells potatoes in bags of 15 kg each. She has 8 bags to sell. How many kilograms of potatoes does she have to sell? **120**
32. Susan tied beets together in bunches of 6 beets each. She made 37 bunches. How many beets does Susan have to sell? **222**
33. Mr. Hill needs 8 dozen ears of corn. How many ears of corn are in 8 dozen? **96**

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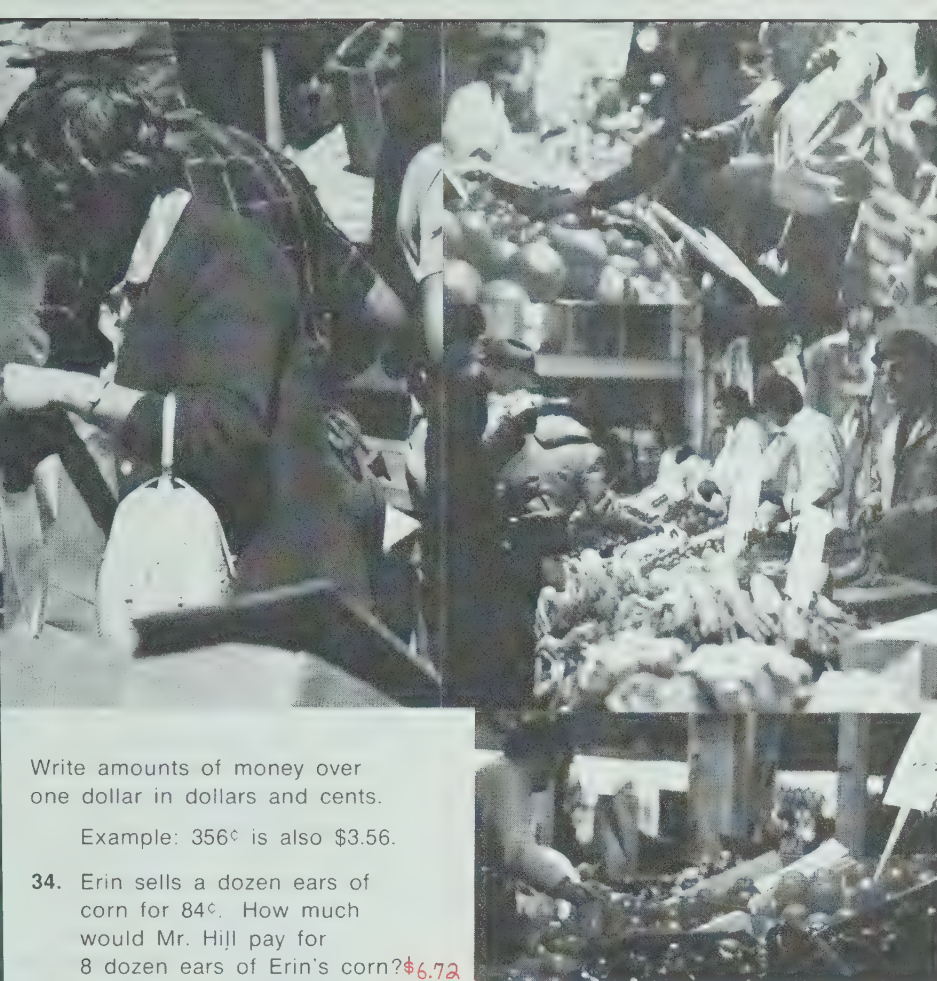
LESSON ACTIVITY

Using the Pages

- Use the photographs of fruit and vegetable stands at a market to motivate a discussion. Have children name fruits and vegetables they recognize. Ask which of these grow in the area where they live. Select one of the exercises and develop the solution on the board with the children. Review the steps of the standard algorithm for multiplication. To solve some of the word problems, the children must recall that one dozen means twelve items. Use the example preceding Ex. 34 to review how to write amounts of money greater than 99¢.

Ex. 37 is starred because it contains more information than is needed to solve the problem. Ex. 38 is a challenge for the more capable children. Information from other problems is required to solve this problem. Tell the children that Mr. Hill requires eight dozen ears of corn and that this

implies that to buy corn from Susan, eight sacks would be required (as corn is sold by the sack, not by the ear). Help children with reading the word problems as needed.



Write amounts of money over one dollar in dollars and cents.

Example: 356¢ is also \$3.56.

34. Erin sells a dozen ears of corn for 84¢. How much would Mr. Hill pay for 8 dozen ears of Erin's corn? **\$6.72**
35. Mrs. Souza sells corn too. She has it in bags with 16 ears in each bag. How many ears are in 6 bags? **96**
36. Mrs. Souza sells each bag for 96¢. How much would Mr. Hill pay for 6 bags of Mrs. Souza's corn? **\$5.76**

- *37. Susan put 13 ears of corn into each sack. She sold each sack for 79¢. How much would Mr. Hill pay for 7 sacks of Susan's corn? **\$5.53**
- *38. Should Mr. Hill buy corn from Erin, Mrs. Souza, or Susan?
(It is cheaper by the ear from Mrs. Souza.)

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RELATED ACTIVITIES

- Have children practice multiplication facts in groups of four using four sets of numeral cards for the numbers 1 to 10. The cards are shuffled and spread out face down. Each player, in turn, draws two cards and names the product of the numbers shown. If the product named is correct, the player keeps the cards. If not, the cards are returned face down to the pile. When all the cards are taken, the player with the most cards is the winner.

- Children may explore the product of three one-digit numbers using the cards described for the above game. Each child draws three cards and finds the product of the numbers shown in three ways. For example, for the numbers 4, 6, and 9, a player may write,

4	6	9
$\times 6$	$\times 9$	$\times 4$
24	54	36
$\times 9$	$\times 4$	$\times 6$
216	216	216

- Activities involving measurement and multiplication are suitable at this time. For example, "Find a flight of stairs that has no more than nine steps. Measure the height of one step. Use multiplication to find the height of the flight of stairs."

OBJECTIVE

Consider different solutions for problems having more than one solution

RELATED ACTIVITIES

• A word problem that has more than one solution may be written on a card and the card placed on display for several days. A child can write one possible solution on a sheet of paper and display it beside the problem card. Other children can contribute solutions until all possibilities have been obtained or until the pattern of all possible solutions is evident. Some examples are given.

1. Color a row of seven squares so that one square is green, two squares are blue, and four squares are red.
2. The sum of three numbers is 5. What are the numbers?
3. The product of two numbers is 24. What are the numbers?

Some children may be able to contribute examples of problems to be solved.

More Than One Solution

Some problems have more than one solution.

Example: Virginia has 10¢. She wants to buy two postage stamps. How much will each stamp cost?

There are five possible solutions for this problem.

Virginia could buy

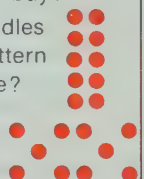
a 1¢ stamp and a 9¢ stamp,
a 2¢ stamp and an 8¢ stamp,
a 3¢ stamp and a 7¢ stamp,
a 4¢ stamp and a 6¢ stamp,
or two 5¢ stamps.

For a problem like this, it is best if you can show all solutions. When there are too many solutions to show, you should at least say that there are other solutions.

Many answers are possible. Some are given.

Each of these has more than one solution. Give all the solutions, if you can.

1. The sum of two numbers is 11. What are the numbers? 5, 6; 7, 4
2. The difference of two numbers is 2. What are the numbers? 7, 5; 16, 14; 270, 268
3. How many coins are needed to make 15¢? 1 dime, 1 nickel; 3 nickels;
4. Sue Ann has 3 coins. What could their values be?
5. Hal has 7¢ to spend for three stamps. How much could he spend for each stamp? 5¢, 1¢, 1¢; 4¢, 1¢, 2¢
6. Abby has 24¢ to spend for some 2¢ stamps and some 3¢ stamps. How many of each could she buy?
7. How could you cut a rectangular cake into four equal pieces?
8. How could 10 candles be placed in a pattern on a birthday cake?
9. How could you place 12 square shapes together to form a rectangular shape?
10. Jane Gray used



J G

to make her initials. What initials could be made with these?

A B C

BAC,
ABC, ACB,
CAB, CBA

PROBLEM SOLVING

4. 5¢, 10¢, 25¢; 1¢, 5¢, 10¢; 5¢, 5¢, 25¢
6. six 2¢ stamps, four 3¢ stamps; nine 2¢ stamps, two 3¢ stamps

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LESSON ACTIVITY

Using the Page

- Many problems that the children have solved have had only one possible solution. Explain that some problems have many possible solutions. Tell them that the problems on page 290 have more than one solution.

Use the problem in the worked example to introduce the concept of many solutions for one problem. (It is assumed that Virginia must not spend less than ten cents.)

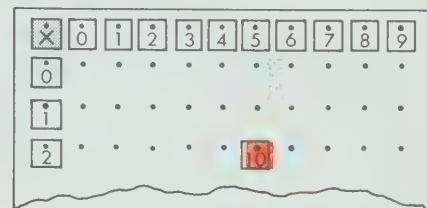
You may wish to have the children complete the word problems independently or in groups. To discuss the exercises, different children can each contribute one solution for a problem. For Ex. 2, the number of solutions is infinite. The solutions may be arranged to form a pattern as follows: 2 - 0, 3 - 1, 4 - 2, and so on. Children can draw diagrams to show solutions for Ex. 7, 8, and 9.

OBJECTIVE

Demonstrate an understanding of the concepts and skills presented in this unit

RELATED ACTIVITIES

- A number board showing a multiplication table is useful.



Obtain a piece of plywood that is 60 cm by 75 cm and about 1 cm thick. Place 121 nails (or hooks) at 5 cm intervals in a square array, forming eleven rows with eleven nails in each row. Geopaper (copies of page T 366) may be taped to the board to assist in placing the nails. Prepare 20 numeral tags of one color for factors (2 for each of the numbers 0 to 9), 100 tags of another color for products, and 1 tag of a third color for the \times symbol. Punch each tag with a hole for hanging from the nails. When the factor tags and the operation tag are in place, have children help hang the tags for products. Leave the board on display for reference. As basic facts are mastered, the corresponding product tags may be turned with the blank side out.

Checking Up

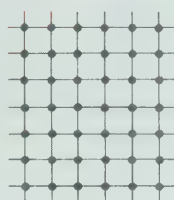
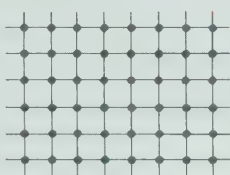
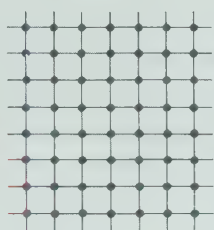
Name the picture that matches each product. Multiplication sentences with the factors in the opposite order are acceptable.

Picture A

Picture B

Picture C

- 7×6
 - 6×8
 - 8×7
1. C, $7 \times 6 = 42$
2. B, $6 \times 8 = 48$
3. A, $8 \times 7 = 56$



Multiply.

- 8×9 72
- 6×6 36
- 7×8 56
- 6×9 54
- 8×8 64
- 9×7 63
- 7×6 42
- 6×9 54
- 30×2 60
- 140×7 980
- 50×4 200
- 60×3 180
- 10×7 70
- 30×2 60
- 23×3 69
- 13×2 26
- 21×4 84
- 32×2 64
- 37×2 74
- 23×4 92
- 16×3 48
- 19×5 95
- 59×2 118
- 23×5 115
- 24×8 192
- 56×7 392
- 73×9 657

Solve.

- 9 rolls of film.
20 pictures on each roll. How many pictures in all? 180
- 24 h in each day.
7 d in each week.
How many hours in a week? 168
- 4 pans.
12 muffins in each pan. How many muffins in all? 48
- 64 crayons in each box.
8 boxes of crayons.
How many crayons in all? 512

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Skills	Exercises	Related Pages
Use rows and columns of dots to multiply	1-3	T 296-T 297 T 298, T 299
Use products	4-12	T 301-T 303
Multiply with multiples of ten as factors	13-17	T 306-T 307
Multiply using the standard algorithm with no regrouping	18-22	T 314-T 315
Multiplying using the standard algorithm with regrouping	23-32	T 314-T 315
Solve multiplication problems	33-36	

Comments

Frequent drill is important to enable the children to learn and remember multiplication facts. If the number facts that children have learned are not maintained, they may be forgotten.

A variety of the activities and games suggested in Units 8 and 15 could be used often for reinforcement. If a product cannot be recalled, the children's understanding of the concept of multiplication enables them to find the product by using repeated addition, drawing a picture, drawing an array, or using a number line.

Determine whether errors in Ex. 13-32 are caused by forgetting multiplication facts, not multiplying the digit in the tens' place correctly, not regrouping when necessary, regrouping when not necessary, or regrouping incorrectly. Reteach as needed and provide more practice for reinforcement. Lesson and exercise ideas as well as activities or games may be found on the appropriate pages in the unit.

Unit 16 Overview

Division

This unit provides an opportunity to review the partitive (sharing) and quotitive (grouping) aspects of division and to consolidate basic division facts for divisors to 5. This, essentially, was the work of Unit 9 in which the concept of division was formally introduced. Division is reviewed in relation to forming equal groups when either the number of groups or the number in each group is known. More emphasis is given to the use of multiplication to divide. New multiplication facts derived in Unit 15 are now useful in extending division facts to include 6, 7, 8, and 9 as divisors. The unit concludes with the concept of remainders greater than zero. The format of the standard algorithm for division is used in order that the operations of multiplication and subtraction may be shown.

Prerequisite Skills

- complete basic multiplication facts to $9 \times 9 = 81$
- determine the second factor to complete a basic multiplication fact, to $9 \times \underline{\quad} = 81$
- find the number in each group when the number of groups is known (partitive division)
- find the number of groups when the number in each group is known (quotitive or measurement division)
- use subtraction to find the quotient for a basic division fact, divisors to 5

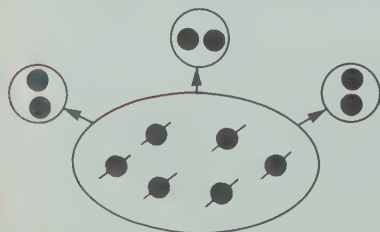
Unit Outcomes

- demonstrate the ability to divide by using equal groups or repeated subtraction, divisors to 5
- use multiplication to divide, basic facts for divisors to 5; use the symbol $\overline{)}$ to show division facts
- use multiplication to divide, basic facts for divisors to 9; solve related word problems
- draw a picture or use repeated subtraction to find a quotient and a remainder, two-digit dividends
- use the standard algorithm to divide, one-digit divisors and one-digit quotients with remainders
- write a concluding statement for a word problem

Background

In Unit 9, division was examined from two aspects, the partitive approach and the quotitive approach. Both approaches involve the concept of equal groups. Briefly, partitive division is related to sharing equally in which the number of equal groups (shares) is known. Finding the quotient corresponds to finding the number in each of the equal groups. Quotients were found by drawing pictures, by using repeated subtraction, and later, by arrays and the use of multiplication.

6 shared equally in 3 groups



$$\begin{array}{r} 6 \\ - 3 \\ \hline 3 \\ - 3 \\ \hline 0 \end{array}$$

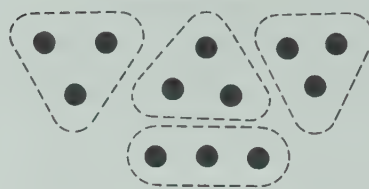
2 subtractions

$$6 \div 3 = 2$$

2 in each group

In quotitive (measurement) division, the number in each group is known. Finding the quotient corresponds to finding how many equal groups there are. Quotients were found using the same methods as for partitive division.

12 placed in groups of 3



4 groups

$$\begin{array}{r} 12 \\ - 3 \\ \hline 9 \\ - 3 \\ \hline 6 \\ - 3 \\ \hline 3 \\ - 3 \\ \hline 0 \end{array}$$

4 subtractions

$$12 \div 3 = 4$$

An understanding of both approaches is essential for later work, particularly in division with decimals. For example, $2\overline{)0.6}$ may best be approached using partitive division. The interpretation is, "Six tenths are shared in two equal groups. How many tenths are in each group?" A division such as $0.2 \overline{)1.0}$ may be considered from the quotitive aspect, which asks, "How many groups of two-tenths are there in one whole?"

The first lesson of this unit reviews the division concept, notation, and terminology that were introduced in Unit 9. This involves basic division facts for divisors to 5. The second lesson provides practice for the same facts, but the facts are written using the symbol $\overline{)}$. Introducing the symbol at this time enables children to become familiar with its use without the additional involvement of new division facts. It prepares the children for the standard algorithm for division when the operations of multiplication and subtraction are shown in the procedure. After its introduction, the symbol $\overline{)}$ is used exclusively throughout the unit. Note that a division fact written in the new notation

read in the usual way. For example, both $45 \div 5 = 9$ and $5 \overline{)45}$ are read, "Forty-five divided by five equals nine".

With the introduction of the symbol $\overline{)}$, greater emphasis can be given to using multiplication to divide. Children have had considerable opportunity to complete multiplication facts in the form of multiplication tables. A division exercise written with the symbol $\overline{)}$ can be related easily to the multiplication fact that helps in finding the quotient. For example,

$$\begin{array}{c} ? \quad \times \quad ? \quad \times \quad 8 \\ 4 \overline{)32} \rightarrow 4 \overline{)32} \rightarrow 4 \overline{)32} \rightarrow 4 \overline{)32} \end{array}$$

By knowing multiplication facts, division facts can be completed more efficiently than by the methods presented in the early exploration of division concepts.

Basic division facts are now extended to include divisors of 7, 8, and 9. The division facts are derived from the corresponding multiplication facts which are summarized first in multiplication tables. By completing multiplication tables first, children review the multiplication facts that are related to the division facts that will be encountered. The completed table may then be referred to as needed to help in finding quotients.

Word problems present both sharing situations and measurement situations to help children recognize that each is related to division. Note that the multiplication table on page 300 does not

ow zero as a factor. This is in keeping with the fact that division by zero is undefined (see Unit 9 Overview). Basic facts for multiplication and division are applied when children make and interpret a pictograph.

To introduce the concept of remainders in division, earlier approaches to finding a quotient are used. Specifically, the use of a picture and repeated subtraction are reviewed in situations that involve sharing equally and forming equal groups. The concept of remainders is not likely a difficult one for children. More frequently than not, amounts are “left over” in real-life situations that involve sharing or grouping.

It is important that children understand that the process of sharing, grouping, or subtracting continues as long as possible; in other words, until there are not enough to share equally or to form another complete group, or until the difference in subtraction is less than the number being subtracted. In terms of division, the remainder is less than the divisor. For example, for $10 \div 4$, the remainder, 2, is less than the divisor, 4. Note that the remainder is shown to the right of the quotient with the letter R.

The lesson following the introduction of remainders in division returns to the use of multiplication to divide. Once again, multiplication tables are helpful in finding the quotient. Because remainders are involved, it is necessary to find the appropriate multiplication fact so that the remainder will be less than the divisor. Because the operations of multiplication and subtraction are involved in the division operation, exercises are shown in the form of the standard algorithm. For example,

$$\begin{array}{r} 9 \text{ R}5 \\ 7 \overline{)68} \\ \underline{63} \\ 5 \end{array}$$

Teaching Strategies

A review of division concepts and notation may best be carried out with the use of concrete objects similar to those that are used in introducing the concept of division in Unit 9. Small objects for grouping or sharing may be used with paper plates as holders. The grouping aspect of division can be illustrated using the elevator beads described in the Overview for Unit 8. For example, to illustrate the division fact $24 \div 4 = 6$, 24 beads may be separated from the other beads on the string. The beads can then be separated into groups of 4 beads and the groups counted.

It is important to review both the partitive and the quotitive aspects of division and to relate each to the process of repeated subtraction. Note, however, that children may choose, according to their preference, to draw a picture that shows sharing or a picture that shows grouping, when they are asked to draw a picture and write the division sentence for an exercise as on page 38.

Since more emphasis is given to using multiplication to divide, especially when the algorithm is used, an ongoing review and practice of the basic multiplication facts is recommended. This should involve the inverse relationship between multiplication and division. In review, the basic facts may be considered in related sets.

$9 \times 4 = 36$	$36 \div 9 = 4$	$7 \times 7 = 49$
$4 \times 9 = 36$	$36 \div 4 = 9$	$49 \div 7 = 7$

Perhaps all the related facts for one set can be derived from one fact shown on a card in the following way.

$$\begin{array}{r} \times 9 \\ 4 \overline{)36} \end{array}$$

$$\begin{array}{r} \times 7 \\ 7 \overline{)49} \end{array}$$

Suggestions for reviewing and practicing multiplication and division facts are provided in the *Related Activities* that accompany each lesson.

Although greater emphasis is given to using multiplication to divide, it will be important to many children to see concrete

evidence for new division facts. For example, although $7 \overline{)21} \times 3$ implies $7 \overline{)21}$, some children may need to be assured of the division fact by using a method such as arranging 21 counters in rows of 7 counters, drawing a picture of 21 objects shared in 3 equal groups, starting at 21 and jumping by 3's back to 0 on the number line, and starting with 21 and subtracting 3's.

Concrete objects are particularly important in introducing the concept of remainders in division. Children can share buttons, beads, or counters and discover that it is not always possible for all objects to be shared equally. For example, 18 objects shared equally by 3 gives 6 to each, but 18 objects shared by 4 gives only 4 to each, if all shares are to be equal. Similar discoveries can be made in forming equal groups; for example, removing groups of 5 from a set of 15 objects gives 3 groups, but removing groups of 5 from a set of 14 objects gives only 2 equal groups. The children may be asked, “How many equal groups are there?” and “Why can another group not be formed?” Children can associate the amount “left over” with the last difference in a repeated subtraction, or more particularly, with the difference obtained in the subtraction step of the division algorithm.

Depending on the ability of the children, you may prefer to keep the work of division with remainders at the exploratory level. The concept will be formally introduced again in the fourth year of the elementary mathematics program.

Materials

counters for each child
copy of page T 360 for each child

Vocabulary

pictograph remainder concluding statement

LESSON OUTCOME

Demonstrate the ability to divide by using equal groups or repeated subtraction, divisors to 5

Materials

24 counters for each child

16 DIVISION

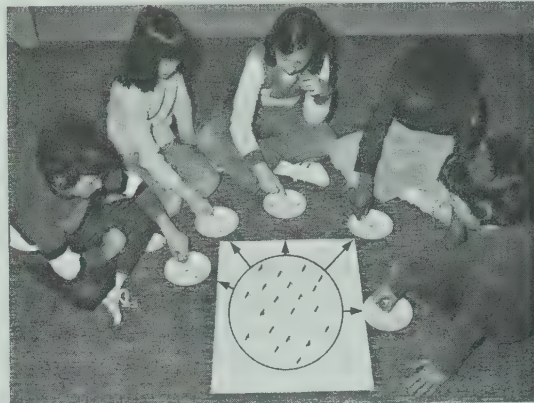
Division Concepts and Notation – Review

20 marbles. 5 children.
How many marbles for each child?

A picture can show how
20 are shared equally by 5.

Divide 20 by 5.

Subtract 5 at a time as
each child takes a marble.



There are 4 marbles
for each child.

$$\begin{array}{r} 20 \\ - 5 \\ \hline 15 \\ - 5 \\ \hline 10 \\ - 5 \\ \hline 5 \\ - 5 \\ \hline 0 \end{array}$$

There are 4 subtractions.

The division sentence

$$20 \div 5 = 4$$

shows 20 divided
by 5 equals 4.

Working Together

Complete the division
sentence for each picture.

1. $6 \div 3 = 2$

2. $24 \div 4 = 6$

Draw a picture and give the
division sentence for each.

3. $9 \div 3 = 3$ 4. $12 \div 2 = 6$

What number do you subtract
each time to find

5. $12 \div 3 = 3$ 6. $15 \div 5 = 3$

How many times do you
subtract in finding

7. $12 \div 3 = 4$ 8. $15 \div 5 = 3$

Use subtraction to find the quotient.
Give the division sentence.

9. $35 \div 5 = 7$ 10. $20 \div 4 = 5$

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LESSON ACTIVITY

Before Using the Pages

- Have each child take twenty-four counters and form four equal groups of counters. Ask how many counters are in each group. Provide a few similar examples. Draw the children's attention to the fact that the number in all and the number of equal groups are given and that they are finding the number in each group.

Have the children take sixteen counters and form groups of two. Ask how many groups there are. Use a few similar examples. Point out that the number in all and the number in each group are given and that they are finding the number of groups.

Using the Pages

- The worked example at the top of page 292 reviews division as sharing equally. The worked example at the top of page 293 reviews division as taking equal groups. Use each of

these examples to review that a quotient can be found by

- drawing a picture to show sharing or grouping,
- using repeated subtraction and counting the subtractions.

Ask the following questions.

"How many marbles are shown in the black ring in the photograph?"

"How does the photograph show that all the marbles are shared?"

"How many marbles does each child get?"

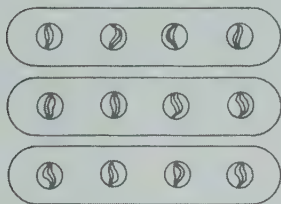
"In the subtractions, why is five subtracted each time?"

Point out that the subtraction chain is abbreviated in the form of one long column. Review the terms *divide*, *division sentence*, and *quotient*, and the symbol \div for "divide by".

Working Together: Use Ex. 1 and 2 to review how the quotient is shown by a picture that illustrates sharing equally or taking equal groups. Ask the following questions for Ex. 1: "What does the 6 in the division sentence $6 \div 3 = \square$ tell about the picture? What does the 3 represent?"

12 marbles. 4 marbles for each child. How many children get marbles?

A picture can show 12 ringed in groups of 4.



Subtract 4 at a time (for each group of 4).

$$\begin{array}{r} 12 \\ - 4 \\ \hline 8 \\ - 4 \\ \hline 4 \\ - 4 \\ \hline 0 \end{array}$$

Divide 12 by 4.

The division sentence

$$12 \div 4 = 3$$

shows 12 divided by 4 equals 3.

3 is the quotient.

There are 3 groups.

There are 3 subtractions.

3 children get marbles.

Exercises

Draw a picture and write the division sentence for each.

1. $8 \div 2 = 4$
2. $10 \div 5 = 2$
3. $16 \div 4 = 4$
4. $12 \div 2 = 6$
5. $9 \div 3 = 3$
6. $15 \div 3 = 5$

Use subtraction to find each quotient. Write the division sentence.

7. $30 \div 5 = 6$
8. $21 \div 3 = 7$
9. $18 \div 3 = 6$
10. $6 \div 2 = 3$
11. $24 \div 3 = 8$
12. $25 \div 5 = 5$

Divide. Draw a picture or use subtraction if you need to.

13. $10 \div 2 = 5$
14. $4 \div 4 = 1$
15. $45 \div 5 = 9$
16. $5 \div 1 = 5$
17. $8 \div 4 = 2$
18. $16 \div 2 = 8$
19. $40 \div 5 = 8$
20. $36 \div 4 = 9$
21. $32 \div 4 = 8$
22. $27 \div 3 = 9$
23. $4 \div 2 = 2$
24. $14 \div 2 = 7$

Solve. Show each division.

25. 45 marbles.
5 children.
How many marbles $45 \div 5 = 9$ for each child? 9
26. 28 marbles.
4 marbles for each child. How many $28 \div 4 = 7$ children get marbles? 7

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RELATED ACTIVITIES

- Cut sections of geopaper from copies of page T366 to prepare work sheets with exercises similar to the following. Have children ring equal groups to find the quotients.



- Use the second activity on page T179 to reinforce the concept of sharing equally. Children may explore sharing situations of their own and write the corresponding division exercises. (The concept of remainders may arise in this activity.)

- Have children practice basic multiplication facts to help them with division. The game described on page T167 may be adapted for multiplication facts to $9 \times 9 = 81$. Instead of tossing two dice, players may spin a spinner twice to select two factors from 1 to 9. The game board should show factors from 1 to 9.

- Work sheets having exercises similar to the one shown can be used to review basic facts for the four operations.

Which of these is not a name for 7?

$$\begin{array}{ll} 12 - 5 & 28 \div 4 \\ 3 + 4 & 0 \times 7 \end{array}$$

Assessment

Divide. Draw a picture or use subtraction if you need to.

1. $12 \div 3 = 4$
2. $18 \div 2 = 9$
3. $4 \div 4 = 1$
4. $35 \div 5 = 7$
5. $6 \div 1 = 6$

“What do you count to find the quotient?”

Ask similar questions for Ex. 2.

When drawing pictures for Ex. 3 and 4, children may choose to interpret the division as either sharing or taking equal groups. Ex. 5-10 review the skills involved in using repeated subtraction to find a quotient. On the basis of the children's answers, use similar exercises.

Exercises: Ex. 1-6 provide practice with drawing a picture to find a quotient. For Ex. 7-12, the children use subtraction to find a quotient. Encourage children who are able to recall division facts from memory to complete Ex. 13-24 without drawing pictures or using repeated subtraction. These methods can be used when children are not certain about division facts or when errors are to be corrected. In the word problems, children will encounter both aspects of division: Ex. 25 is an example of a sharing situation; Ex. 26 is an example of a grouping situation.

Working Together

Use $\overline{)}\quad$ to show each division fact.

1. $30 \div 5 = 6$ $5\overline{)30}$ 2. 8 divided by 2 equals 4. $2\overline{)8}$

Use the multiplication tables to help you complete each of these.

$\times \begin{array}{c} ? \\ 7 \end{array}$

3. $2\overline{)14}$

$\times \begin{array}{c} ? \\ 6 \end{array}$

4. $3\overline{)24}$

$\times \begin{array}{c} ? \\ 8 \end{array}$

5. $4\overline{)24}$

$\times \begin{array}{c} ? \\ 9 \end{array}$

6. $5\overline{)45}$

$\times \begin{array}{c} ? \\ 7 \end{array}$

7. $2\overline{)16}$

$\times \begin{array}{c} ? \\ 8 \end{array}$

8. $3\overline{)21}$

$\times \begin{array}{c} ? \\ 9 \end{array}$

9. $4\overline{)36}$

10. $5\overline{)30}$

$\times \begin{array}{c} 1 \\ 2 \end{array} \begin{array}{c} 2 \\ 4 \end{array} \begin{array}{c} 3 \\ 6 \end{array} \begin{array}{c} 4 \\ 8 \end{array} \begin{array}{c} 5 \\ 10 \end{array} \begin{array}{c} 6 \\ 12 \end{array} \begin{array}{c} 7 \\ 14 \end{array} \begin{array}{c} 8 \\ 16 \end{array} \begin{array}{c} 9 \\ 18 \end{array}$

$\times \begin{array}{c} 1 \\ 3 \end{array} \begin{array}{c} 2 \\ 6 \end{array} \begin{array}{c} 3 \\ 9 \end{array} \begin{array}{c} 4 \\ 12 \end{array} \begin{array}{c} 5 \\ 15 \end{array} \begin{array}{c} 6 \\ 18 \end{array} \begin{array}{c} 7 \\ 21 \end{array} \begin{array}{c} 8 \\ 24 \end{array} \begin{array}{c} 9 \\ 27 \end{array}$

$\times \begin{array}{c} 1 \\ 4 \end{array} \begin{array}{c} 2 \\ 8 \end{array} \begin{array}{c} 3 \\ 12 \end{array} \begin{array}{c} 4 \\ 16 \end{array} \begin{array}{c} 5 \\ 20 \end{array} \begin{array}{c} 6 \\ 24 \end{array} \begin{array}{c} 7 \\ 28 \end{array} \begin{array}{c} 8 \\ 32 \end{array} \begin{array}{c} 9 \\ 36 \end{array}$

$\times \begin{array}{c} 1 \\ 5 \end{array} \begin{array}{c} 2 \\ 10 \end{array} \begin{array}{c} 3 \\ 15 \end{array} \begin{array}{c} 4 \\ 20 \end{array} \begin{array}{c} 5 \\ 25 \end{array} \begin{array}{c} 6 \\ 30 \end{array} \begin{array}{c} 7 \\ 35 \end{array} \begin{array}{c} 8 \\ 40 \end{array} \begin{array}{c} 9 \\ 45 \end{array}$

Give the multiplication fact that can be used for each division. Then complete the division fact.

11. $5\overline{)15}$
 $5 \times 3 = 15$

12. $4\overline{)16}$
 $4 \times 4 = 16$

13. $3\overline{)27}$
 $3 \times 9 = 27$

14. $4\overline{)20}$
 $4 \times 5 = 20$

Exercises

Write the multiplication fact that can be used for each division. Then complete the division fact.

$2 \times 5 = 10$ 5 $3 \times 6 = 18$ 6 $4 \times 3 = 12$ 3 $5 \times 5 = 25$ 5 $4 \times 7 = 28$ 7

1. $2\overline{)10}$ 2. $3\overline{)18}$ 3. $4\overline{)12}$ 4. $5\overline{)25}$ 5. $4\overline{)28}$

$3 \times 5 = 15$ 5 $5 \times 4 = 20$ 4 $2 \times 9 = 18$ 9 $3 \times 4 = 12$ 4 $5 \times 8 = 40$ 8

6. $3\overline{)15}$ 7. $5\overline{)20}$ 8. $2\overline{)18}$ 9. $3\overline{)12}$ 10. $5\overline{)40}$

$3 \times 3 = 9$ 3 $4 \times 8 = 32$ 8 $2 \times 3 = 6$ 3 $5 \times 6 = 30$ 6 $5 \times 7 = 35$ 7

11. $3\overline{)9}$ 12. $4\overline{)32}$ 13. $2\overline{)6}$ 14. $5\overline{)30}$ 15. $5\overline{)35}$

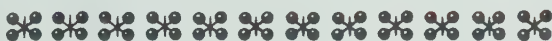
$2 \times 7 = 14$ 7 $4 \times 6 = 24$ 6 $3 \times 8 = 24$ 8 $5 \times 9 = 45$ 9 $3 \times 7 = 21$ 7

16. $2\overline{)14}$ 17. $4\overline{)24}$ 18. $3\overline{)24}$ 19. $5\overline{)45}$ 20. $3\overline{)21}$

Divide to solve each problem.

Write the multiplication fact you use.

12 jacks.



How many pickups if you take

1. $1 \times 12 = 12$
21. 1 at a time? 12
 $4 \times 3 = 12$

2. $2 \times 6 = 12$
22. 2 at a time? 6
25. 6 at a time? 2
 $6 \times 2 = 12$

3. $3 \times 4 = 12$
23. 3 at a time? 4
26. 12 at a time? 1
 $12 \times 1 = 12$

295

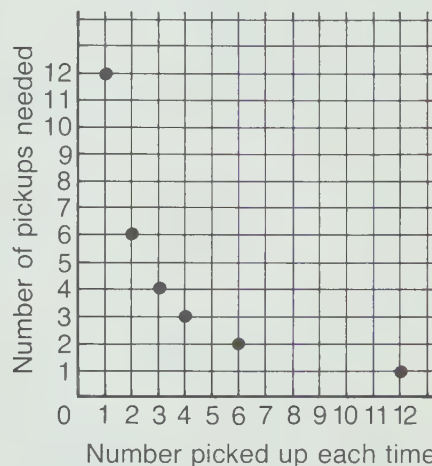
RELATED ACTIVITIES

• Children who require objects to practice division may use the materials described for the second activity on page T 179 to help complete exercises similar to the following.

$4\overline{)20}$ $3\overline{)18}$ $5\overline{)15}$ $2\overline{)14}$

• Children may find it interesting to illustrate the results of Ex. 21-26 in the form of a graph as shown. The fact that the points form a curve rather than a straight line may motivate children to investigate similar situations. For example, the number of pickups there will be for 24 jacks if 1, 2, 3, 4, 6, 8, 12, or 24 jacks are picked up each time.

PICKING UP 12 JACKS



Compare the position of each number in the division sentence with its position in the new division notation. Use similar exercises as needed.

The sequence of Ex. 3-10 leads children to think of a quotient as the missing second factor of a multiplication fact. The multiplication tables at the top right of page 295 provide assistance.

After the children have completed Ex. 11-14, send volunteers to the board to show and explain their work.

Exercises: By writing the multiplication fact first and then the division fact for each exercise, the children will be considering facts in pairs, for example,

$\begin{array}{r} \times 5 \\ 2 \overline{)10} \end{array}$ and $\begin{array}{r} 5 \\ 2 \overline{)10} \end{array}$ Through this procedure, children will see that knowing a multiplication fact helps in recalling the related division fact.

Ex. 21-26 demonstrate that for twelve jacks there are fewer pickups if more jacks are picked up each time. Similarly, there are more pickups if fewer jacks are picked

up each time. This kind of situation is met in Ex. 3-6 on page 172. This relationship can be expressed in terms of multiplication or in terms of division as follows.

1. When the product remains the same while one factor increases, the other factor decreases.
2. When the dividend remains the same while the divisor increases, the quotient decreases.

Assessment

Write the multiplication fact that can be used for each division. Then complete the division fact.

1. $4\overline{)24}$ $4 \times 6 = 24$ 2. $3\overline{)27}$ $3 \times 9 = 27$ 3. $4\overline{)28}$ $4 \times 7 = 28$ 4. $5\overline{)15}$ $5 \times 3 = 15$ 5. $2\overline{)18}$ $2 \times 9 = 18$

LESSON OUTCOME

Use multiplication to divide, basic facts for divisors to 7

Materials

counters for each child

Prerequisite Skills

Determine the second factor to complete a basic multiplication fact

Checking Prerequisite Skills

Complete each of the following.

1. $7 \times \underline{5} = 35$
2. $7 \times \underline{2} = 14$
3. $6 \times \underline{8} = 48$
4. $6 \times \underline{6} = 36$

Using Multiplication to Divide, Divisors to 7

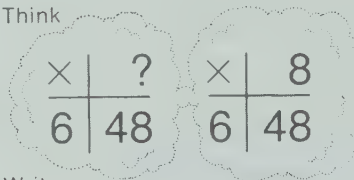


48 children sign up for tug-of-war. There are 6 children to a team. How many teams will there be?

Divide

$$6 \overline{)48}$$

Think



Write

$$\begin{array}{r} 8 \\ 6 \overline{)48} \end{array}$$

There will be 8 teams.

296

Working Together

Complete these multiplication tables.

\times	1	2	3	4	5	6	7	8	9
6	6	12	18	24	30	36	42	48	54

\times	1	2	3	4	5	6	7	8	9
7	7	14	21	28	35	42	49	56	63

Give the multiplication fact that can be used for each division. Then complete the division fact.

- | | | | |
|-----------------------|---|-----------------------|---|
| $7 \times 9 = 63$ | 9 | $6 \times 5 = 30$ | 5 |
| 3. $7 \overline{)63}$ | | 4. $6 \overline{)30}$ | |
| $6 \times 9 = 54$ | 9 | $7 \times 6 = 42$ | 6 |
| 5. $6 \overline{)54}$ | | 6. $7 \overline{)42}$ | |

LESSON ACTIVITY

Before Using the Pages

- Have each child place twenty-eight counters in rows of seven. Ask how many columns are needed. Use other examples with rows of six and with rows of seven.

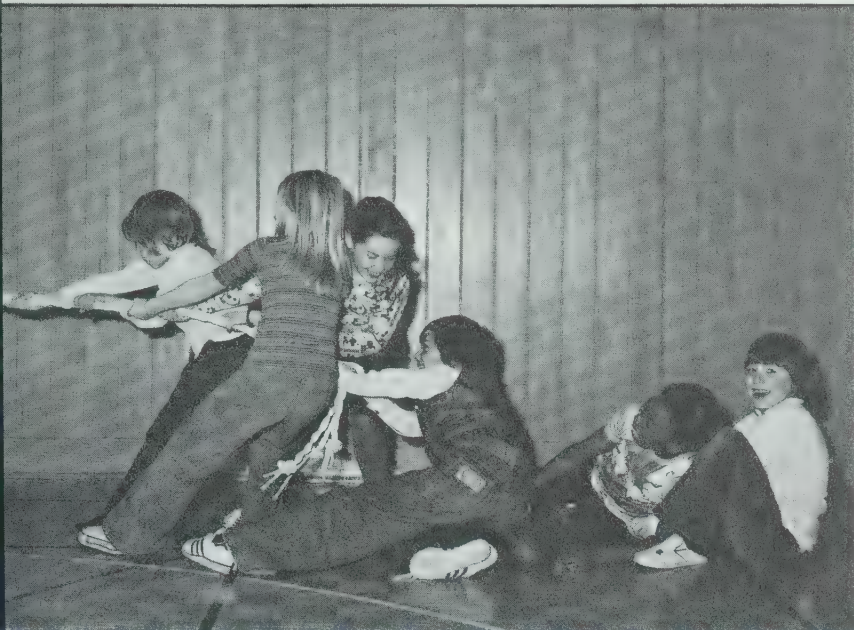
Using the Pages

- Discuss the situation in the photograph at the top of these two pages. Have the children comment on the contest that is taking place. Then ask how many children are on each team. Discuss whether it would be fair to have a different number of children on each team for this contest. Lead the children to realize that if many children wish to take part, several teams could be arranged with the same number of children on each team.

Read the statement that introduces the problem for the worked example. Develop that this problem involves division because it concerns forming equal groups and finding the number of groups. Emphasize that the quotient is found by thinking of a multiplication fact.

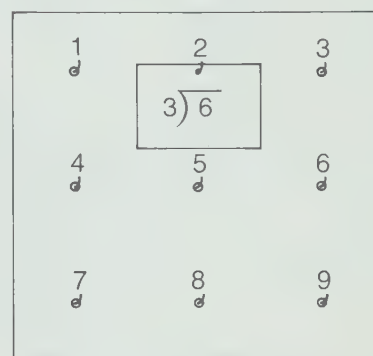
Working Together: These exercises introduce 6 and 7 as divisors. They also reinforce the concept that knowing multiplication facts makes it easier to learn division facts. Review how the table is used to find a quotient.

Exercises: Children may need to refer to the tables on pages 295 and 296 for the related multiplication fact for a division. Note that the children encounter both aspects of division in the word problems: sharing equally for Ex. 22 and 23 and taking equal groups for Ex. 21 and 24.



RELATED ACTIVITIES

• Prepare a division board for quotients to 9 as follows. Obtain a piece of Masonite or plywood and place nine cup hooks with a space above each hook. Print the numerals 1 to 9, one above each hook as shown. Prepare cards with a division exercise on each. Punch a hole in each card. Have the children place a card on a hook so that the correct quotient appears above the card. (If plywood is not available, use Bristol board and library book pockets and write the exercises on cards. Have the children place a card in a pocket so that the correct quotient appears above the card.)



- Have children illustrate division facts with divisors of 6 and 7 by showing jumps on a number line.
- Have children use the materials described for the second activity on page T179 to find quotients when the divisors are 6 or 7.

Exercises

Divide. Write the multiplication fact you use.

1. $6 \overline{)42}$ $7 \times 6 = 42$ 2. $7 \overline{)35}$ $5 \times 7 = 35$ 3. $5 \overline{)30}$ $6 \times 5 = 30$ 4. $7 \overline{)21}$ $3 \times 7 = 21$ 5. $4 \overline{)24}$ $6 \times 4 = 24$
6. $2 \overline{)12}$ $6 \times 2 = 12$ 7. $4 \overline{)28}$ $7 \times 4 = 28$ 8. $6 \overline{)36}$ $6 \times 6 = 36$ 9. $3 \overline{)27}$ $9 \times 3 = 27$ 10. $7 \overline{)49}$ $7 \times 7 = 49$
11. $5 \overline{)35}$ $7 \times 5 = 35$ 12. $6 \overline{)18}$ $3 \times 6 = 18$ 13. $4 \overline{)32}$ $8 \times 4 = 32$ 14. $7 \overline{)56}$ $8 \times 7 = 56$ 15. $5 \overline{)15}$ $3 \times 5 = 15$
16. $7 \overline{)28}$ $4 \times 7 = 28$ 17. $4 \overline{)36}$ $9 \times 4 = 36$ 18. $6 \overline{)24}$ $4 \times 6 = 24$ 19. $4 \overline{)20}$ $5 \times 4 = 20$ 20. $7 \overline{)14}$ $2 \times 7 = 14$

Solve. Show each division.

21. 30 children sign up for volleyball. 6 children are on a team. How many $6 \overline{)30}$ teams are there? 5
22. 54 children play softball on 6 teams. How many children $6 \overline{)54}$ are on each team? 9
23. 49 children are in the sack-race relay. 7 teams are entered. How many $7 \overline{)49}$ children are on each team? 7
24. 16 children are in the three-legged race. The children race in pairs. $2 \overline{)16}$ How many pairs are there? 8

297

Assessment

Divide. Write the multiplication fact you use.

1. $6 \overline{)54}$ 9 $9 \times 6 = 54$ 2. $7 \overline{)42}$ 6 $7 \times 6 = 42$ 3. $7 \overline{)28}$ 4 $7 \times 4 = 28$ 4. $5 \overline{)35}$ 7 $5 \times 7 = 35$

Solve. Show the division.

30 children.

6 tug-of-war teams.

How many children on each team? 5 $6 \overline{)30}$

LESSON OUTCOME

Use multiplication to divide, basic facts for divisors to 9

Materials

counters for each child

Prerequisite Skills

Determine the second factor to complete a basic multiplication fact

Checking Prerequisite Skills

Complete each of the following.

1. $8 \times \underline{3} = 24$
2. $8 \times \underline{6} = 48$
3. $9 \times \underline{5} = 45$
4. $9 \times \underline{8} = 72$
5. $4 \times \underline{8} = 32$
6. $3 \times \underline{9} = 27$

Using Multiplication to Divide, Divisors to 9

Jody played 72 holes at the miniature golf course.

How many times did she go around the 9-hole course?

Divide

Think

Write

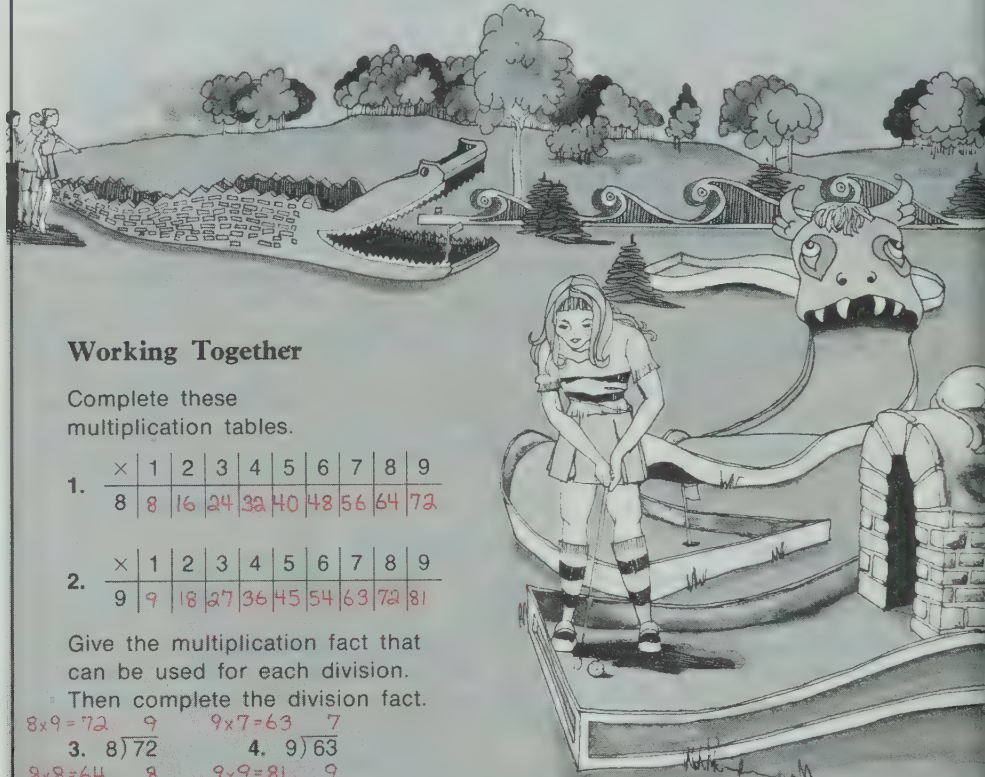
$$9 \overline{)72}$$

$$\begin{array}{r|l} \times & ? \\ 9 & 72 \end{array}$$

$$\begin{array}{r|l} \times & 8 \\ 9 & 72 \end{array}$$

$$9 \overline{)72} \quad 8$$

She went around the course 8 times.



Working Together

Complete these multiplication tables.

1.	\times	1	2	3	4	5	6	7	8	9
	8	8	16	24	32	40	48	56	64	72

2.	\times	1	2	3	4	5	6	7	8	9
	9	9	18	27	36	45	54	63	72	81

Give the multiplication fact that can be used for each division.

Then complete the division fact.

$8 \times 9 = 72$	9	$9 \times 7 = 63$	7
3. $8 \overline{)72}$		4. $9 \overline{)63}$	
$8 \times 8 = 64$	8	$9 \times 9 = 81$	9
5. $8 \overline{)64}$		6. $9 \overline{)81}$	

298

LESSON ACTIVITY

Before Using the Pages

- Have each child place twenty-seven counters in rows of nine. Ask how many rows are formed. Use other examples with rows of eight and with rows of nine.

Using the Pages

- Ask the children if they are familiar with the game of golf. Then ask how it differs from the game of miniature golf. Encourage them to share their experiences related to miniature golf. Suggest that sometimes it is enjoyable to play several games of miniature golf in sequence because one game of nine holes does not take long to play.

Read the statement at the top of page 298 to introduce the word problem for the worked example. Give the children a few moments to study the example. They will probably be able to follow the approach on the page since the worked examples for the previous two lessons are presented in a

similar manner. Discuss the solution. Emphasize the writing the multiplication fact in the form $\begin{array}{r|l} \times & 8 \\ 9 & 72 \end{array}$ helps in

completing the division fact $9 \overline{)72} \quad 8$.

Working Together: These exercises introduce the divisors 8 and 9. Completing the tables gives the children multiplication facts for reference in their work with division.

Exercises: If necessary, the children may refer to the multiplication tables on pages 295, 296, and 298. To emphasize that multiplication and division facts are associated in pairs, you may wish to have several children read answers aloud for a few exercises. For Ex. 1, for example, a child would state, "Since nine times two equals eighteen, eighteen divided by nine equals two."

Problem Solving: These exercises lead the children to look at familiar objects from a new point of view. The problems are intended for discussion and may stimulate interesting ideas relating to measurement. For example, Ex. 2 may

Exercises

Divide. Write the multiplication fact you use.

- | | | | | | |
|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| $7 \times 8 = 18$ | $2 \times 3 = 24$ | $8 \times 6 = 48$ | $6 \times 9 = 54$ | $9 \times 7 = 56$ | $7 \times 6 = 54$ |
| 1. $9 \overline{)18}$ | 2. $3 \overline{)24}$ | 3. $8 \overline{)48}$ | 4. $6 \overline{)54}$ | 5. $8 \overline{)56}$ | 6. $9 \overline{)54}$ |
| $9 \times 1 = 9$ | $7 \times 5 = 35$ | $6 \times 8 = 48$ | $8 \times 2 = 16$ | $9 \times 3 = 27$ | $8 \times 4 = 32$ |
| 7. $9 \overline{)9}$ | 8. $7 \overline{)35}$ | 9. $6 \overline{)48}$ | 10. $8 \overline{)16}$ | 11. $9 \overline{)27}$ | 12. $8 \overline{)32}$ |
| $8 \times 5 = 40$ | $9 \times 4 = 36$ | $7 \times 8 = 56$ | $8 \times 3 = 24$ | $1 \times 8 = 8$ | $9 \times 5 = 45$ |
| 13. $8 \overline{)40}$ | 14. $9 \overline{)36}$ | 15. $7 \overline{)56}$ | 16. $8 \overline{)24}$ | 17. $1 \overline{)8}$ | 18. $9 \overline{)45}$ |

Solve. Show each division.

19. 32 children played golf in $\frac{8}{4}$ groups of 4. How many groups of 4 were there? $4 \overline{)32}$
20. When Jody has played 81 holes, how many times has she gone around the 9-hole course? $9 \overline{)81}$

Make an estimate for each. Tell how you could check each estimate.

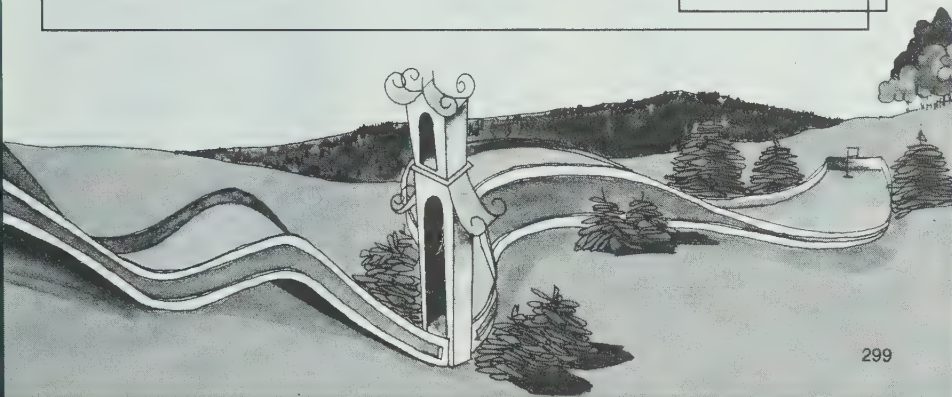
Answers will vary.

- | | | |
|--|--|--|
| 1. How big around is a basketball? | 2. How big around is a football? | 3. How many dimples on a golf ball? |
| 4. How long is the seam of a baseball? | 5. How many "hexagons" on a soccer ball? | 6. Which is larger, a soccer ball or a volleyball? |

List these in order, from the ball you can throw the shortest distance to the ball you can throw the longest distance.

- | | | | |
|----------------|-------------------|--------------|----------|
| 7. tennis ball | baseball | basketball | football |
| golf ball | snowball | bowling ball | |
| soccer ball | table-tennis ball | | |

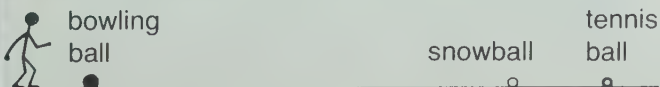
PROBLEM SOLVING



299

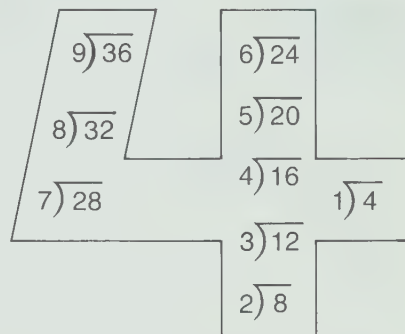
prompt a question about which way around the ball the distance is measured. For Ex. 5, the question of how to keep track of counting the shapes must be considered. For Ex. 1-6, it would be helpful to display one of each kind of ball named. Although children are asked to tell how their estimates could be checked, the actual procedure of checking each estimate remains an option.

Answers to Ex. 7 will be based on each child's perception of how easily he/she can throw the different balls. You may wish to have the children show their answers with a picture. Have them decide which ball they could throw the longest distance and which they could throw the shortest distance and show these in the picture. The remaining balls may be considered one at a time and drawn in relation to the ones already in the picture.



RELATED ACTIVITIES

- Cut large numerals (60 cm to 75 cm in height) from colored paper for the numbers 1 to 9. Write division exercises for basic facts that have a quotient of 1 on the large numeral 1. Help children prepare each of the other large numerals in a similar manner. Display the numerals for reference.



- Have children illustrate division facts with divisors of 8 and 9 by showing jumps on a number line.
- Have children use the materials described for the second activity on page T 179 to find quotients when the divisors are 8 or 9.
- Adapt the first activity on page T 185 for new division facts presented in Unit 16.

Assessment

Divide. Write the multiplication fact you use.

- | | | | |
|-----------------------|----------------------|-----------------------|-----------------------|
| 1. $9 \overline{)63}$ | 2. $8 \overline{)8}$ | 3. $8 \overline{)40}$ | 4. $9 \overline{)72}$ |
| $9 \times 7 = 63$ | $8 \times 1 = 8$ | $8 \times 5 = 40$ | $9 \times 8 = 72$ |

Solve. Show the division.

5. 24 golf balls.
3 golf balls in each package.
How many packages? $8 \overline{)24}$

OBJECTIVE

Demonstrate competence in division;
solve related word problems

Materials

a copy of page T 360 for each child

Vocabulary

pictograph

Practice

Copy and complete this
multiplication table.

1.

×	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9
2	2	4	6	8	10	12	14	16	18
3	3	6	9	12	15	18	21	24	27
4	4	8	12	16	20	24	28	32	36
5	5	10	15	20	25	30	35	40	45
6	6	12	18	24	30	36	42	48	54
7	7	14	21	28	35	42	49	56	63
8	8	16	24	32	40	48	56	64	72
9	9	18	27	36	45	54	63	72	81

This table can
help you with division.
Use it like
this to find $5 \overline{)20}$.

×	4
5	20

The table shows $5 \overline{)20}^4$.

Divide. Use your table if you need to.

2. $9 \overline{)18}$ ²

5. $6 \overline{)12}$ ²

8. $9 \overline{)9}$ ¹

11. $6 \overline{)42}$ ⁷

14. $4 \overline{)16}$ ⁴

17. $7 \overline{)35}$ ⁵

20. $9 \overline{)27}$ ³

23. $2 \overline{)10}$ ⁵

26. $8 \overline{)24}$ ³

29. $8 \overline{)72}$ ⁹

32. $5 \overline{)25}$ ⁵

35. $8 \overline{)32}$ ⁴
3. $3 \overline{)12}$ ⁴

6. $8 \overline{)48}$ ⁶

9. $9 \overline{)45}$ ⁵

12. $8 \overline{)40}$ ⁵

15. $7 \overline{)63}$ ⁹

18. $8 \overline{)16}$ ²

21. $6 \overline{)48}$ ⁸

24. $9 \overline{)54}$ ⁶

27. $9 \overline{)63}$ ⁷

30. $7 \overline{)56}$ ⁸

33. $8 \overline{)64}$ ⁸

36. $7 \overline{)42}$ ⁶
4. $6 \overline{)36}$ ⁶

7. $6 \overline{)54}$ ⁹

10. $7 \overline{)21}$ ³

13. $6 \overline{)24}$ ⁴

16. $3 \overline{)15}$ ⁵

19. $5 \overline{)35}$ ⁷

22. $7 \overline{)49}$ ⁷

25. $7 \overline{)28}$ ⁴

28. $6 \overline{)18}$ ³

31. $9 \overline{)36}$ ⁴

34. $9 \overline{)81}$ ⁹

37. $7 \overline{)14}$ ²

300



LESSON ACTIVITY

Using the Pages

- Discuss the multiplication table on page 300. Have children identify the factors for the three products shown in the table. Write the three multiplication facts on the board. Review that the first factor is chosen from the left column and the second factor is chosen from the top row.
- Give each child a copy of page T 360 to use for the multiplication table. Tell the children to begin by completing the facts they know. For other facts, encourage them to use addition and known facts in the columns to discover the unknown facts. They should also use the commutative property wherever possible; for example, if 3×8 is known, then 8×3 can be completed. Once the table has been completed have the children compare their answers with the table on page 276.
- Demonstrate how the multiplication table can be used to find a quotient. Note that the quotient is found in the top row of the table.



































Remind the children to answer the word problems with sentence. Ex. 42 and 43 are starred because they involve remainders. Children may answer these problems in different ways. For Ex. 42, they may suggest that three boxes would be needed, but that the third box would not be full; or they may suggest that two boxes are needed because there aren't enough balls to fill three boxes. Either answer illustrates that these divisions differ from those encountered previously.

Try This: Children must apply multiplication and division facts to interpret and complete pictographs for these exercises. Before assigning the exercises, discuss Ex. 1. Ask for the month in which the least number of table-tennis games were sold. Then ask how to find the number of table-tennis games sold during that month. It may be necessary to help children prepare the headings for the graph for Ex. 2. Note that for Ex. 3, there will be five divisions, one for each party.

Solve. Show each division.

38. 72 players.
9 players on each team. $9 \overline{)72}$
How many teams? 8
40. 6 players for the card game. 5
30 cards to deal out. How $6 \overline{)30}$
many cards for each player? 5
- *42. 8 table-tennis balls. 2 groups of 3 and 1 group of 2
Each box holds 3 balls. 1 group of 2
How many boxes needed? 3
39. 56 marbles.
8 children share equally. $8 \overline{)56}$
How many marbles for each? 7
41. 18 jacks.
Pick up 3 at a time. $3 \overline{)18}$
How many pickups? 6
- *43. 8 players for the card game.
60 cards to deal out. How
many cards for each player?
 7 cards for 4 players
 8 cards for 4 players

Each  in the pictograph stands for 8 table-tennis games sold at the store.

July	       
August	     
September	   
October	    
November	  
December	       

1. How many table-tennis games were sold each month? July: 64;
August: 56; September: 32; October: 40; November: 24; December: 72
Brenda was at five parties last year.

2. Draw party hats in a pictograph to show how many children came to each party.

Show 5 hats. 20 children at the Halloween party
Show 7 hats. 28 children at Brenda's party
Show 8 hats. 32 children at Karen's party
Show 6 hats. 24 children at the spring party

3. At the parties, 4 children sat at each table.

How many tables were needed for each party?

Let each party hat stand for 4 children.

36 children at the valentine party
Show 9 hats.

try
this

3. the Halloween party: 5
Karen's party: 8

4. Brenda's party: 7
the spring party: 6
the valentine party: 9

301

RELATED ACTIVITIES

- Have the children prepare pictographs similar to the one on page 301. They may be based on pets or favorite games.
- Children may play the game "Product Power" in pairs using a blank multiplication table as on page 300 and thirty-six cards, one for each of the numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 15, 16, 18, 20, 21, 24, 25, 27, 28, 30, 32, 35, 36, 40, 42, 45, 48, 49, 54, 56, 63, 64, 72, 81. The cards are shuffled and placed face down in a pile. The first player draws the top card and colors inside all squares for that product; for example, if the card shows 12, the player would color the squares for 2×6 , 3×4 , 4×3 , and 6×2 . The other player draws the next card and continues in the same way, using a crayon of a different color. If a player omits coloring possible squares for her/his product card, the opponent may color those squares and take her/his turn. The player who colors the most squares is the winner.

LESSON OUTCOME

Draw a picture or use repeated subtraction to find a quotient and the remainder, two-digit dividends

Materials

counters for each child

Vocabulary

remainder

Prerequisite Skills

Use subtraction to find a quotient (zero remainders)

Checking Prerequisite Skills

Use subtraction to find each quotient. Complete the division.

1. $4 \overline{)20}$ 5 2. $6 \overline{)18}$ 3

3. $9 \overline{)36}$ 4 4. $7 \overline{)7}$ 1

Background

To enable children to explore the concept of remainders in division, this lesson recalls division as sharing, as taking equal groups, and as repeated subtraction. The lesson on pages 304-305 returns to the use of multiplication to complete division exercises.

Remainders

3 players share 11 letter tiles. They each take one tile at a time. How many tiles does each player take? How many tiles are left over?



The picture shows that each player can take 3 tiles. There will be 2 tiles left over.

Subtracting 3 at a time shows the same result.

$$\begin{array}{r} 11 \\ - 3 \\ \hline 8 \\ - 3 \\ \hline 5 \\ - 3 \\ \hline 2 \end{array}$$

one for each player
one for each player
one for each player
left over

The number left over is the **remainder**.

A division with remainder can be shown like this

$$\begin{array}{r} 3 \text{ R } 2 \\ 3 \overline{)11} \end{array}$$

302

LESSON ACTIVITY

Before Using the Pages

- Review that division may involve equal sharing. Display twelve counters and have four children demonstrate that when twelve counters are shared equally by four, there are three counters for each. Then repeat this procedure with seventeen counters. Discuss how this situation differs from the first.

Review that division may involve taking equal groups. Have each child take fifteen counters and form groups of three. Ask how many groups there are. Then repeat the procedure with nineteen counters. Ask how this situation differs from the one with fifteen counters.

Using the Pages

- The worked example demonstrates that some division situations involve amounts that are left over. Finding a

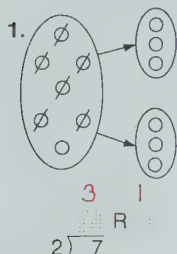
quotient and the remainder is shown using the two familiar procedures of drawing a picture and using repeated subtraction.

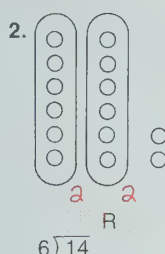
Discuss the situation in the photograph. Identify the game being played as *Scrabble*™. Ask how the game involves sharing letter tiles. Read the statement at the top of page 302 to introduce the word problem. Have the children count the tiles in the black ring to verify that the children began with eleven tiles to share. Lead the children to understand the significance of crossing off the tiles and of the two tiles that are not crossed off.

Read the statement under the photograph to summarize what is shown. Then explain the repeated subtraction. Point out why the subtraction begins with 11, why 3 is subtracted each time, and why the subtraction ends at 2. Point out that the quotient is found, as usual, by counting the subtractions. Introduce the term *remainder* for the number left over. Draw the children's attention to the way of showing the remainder to the right of the quotient.

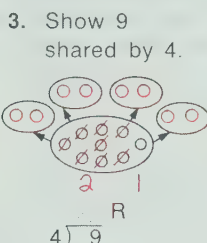
Working Together

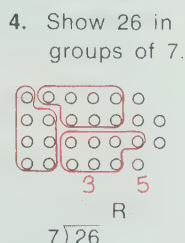
Complete the division to match each picture.

1. 

2. 

Complete each picture and the division.

3. Show 9 shared by 4. 

4. Show 26 in groups of 7. 

Complete the division to match each column of subtraction facts.

5.
$$\begin{array}{r} 17 \\ - 5 \\ \hline 12 \\ - 5 \\ \hline 7 \\ - 5 \\ \hline 2 \end{array}$$
 $5 \overline{) 17}$ R 3

6.
$$\begin{array}{r} 13 \\ - 6 \\ \hline 7 \\ - 6 \\ \hline 1 \end{array}$$
 $6 \overline{) 13}$ R 2

Use subtraction. Find the quotient and remainder.

7.
$$\begin{array}{r} 18 \\ - 8 \\ \hline 10 \\ - 9 \\ \hline 1 \end{array}$$
 $8 \overline{) 18}$ R 2

8.
$$\begin{array}{r} 27 \\ - 6 \\ \hline 21 \\ - 7 \\ \hline 14 \\ - 7 \\ \hline 7 \end{array}$$
 $6 \overline{) 27}$ R 3

9.
$$\begin{array}{r} 45 \\ - 9 \\ \hline 36 \\ - 5 \\ \hline 31 \\ - 3 \\ \hline 28 \end{array}$$
 $9 \overline{) 45}$ R 0

10.
$$\begin{array}{r} 23 \\ - 3 \\ \hline 20 \\ - 7 \\ \hline 13 \\ - 3 \\ \hline 10 \end{array}$$
 $3 \overline{) 23}$ R 2

Exercises

Find the quotient and remainder.

1. $2 \overline{) 13}$ R 1
2. $3 \overline{) 20}$ R 2
3. $8 \overline{) 52}$ R 4
4. $3 \overline{) 25}$ R 1
5. $5 \overline{) 39}$ R 4
6. $7 \overline{) 66}$ R 3
7. $8 \overline{) 22}$ R 2
8. $4 \overline{) 31}$ R 3
9. $8 \overline{) 74}$ R 6
10. $6 \overline{) 37}$ R 1
11. $2 \overline{) 17}$ R 1
12. $9 \overline{) 58}$ R 2
13. $7 \overline{) 43}$ R 1
14. $4 \overline{) 26}$ R 2

15. Use this table to find the letter for each tile.

For this remainder →

use this letter →

0	1	2	3	4	5	6	7	8
E	F	I	M	N	R	S	U	Y

$4 \overline{) 34}$ I	$5 \overline{) 26}$ F			$9 \overline{) 71}$ Y	
$9 \overline{) 60}$ S	$8 \overline{) 39}$ U	$5 \overline{) 38}$ M	$6 \overline{) 57}$ M	$7 \overline{) 42}$ E	$8 \overline{) 45}$ R
	$6 \overline{) 52}$ N			$7 \overline{) 69}$ S	

303

RELATED ACTIVITIES

• Children may use the materials described for the second activity on page T 179 to help find quotients and remainders for exercises similar to those on page 303.

• Children may practice basic division facts by playing one or more of the following games.

1. The game "Lucky Nine" described on page T 195 may be played using cards that show division facts without the arrays. Include new facts presented in Unit 16.
 2. The circle game described on page T 17 may be adapted for division and multiplication. Omit the numeral card for 0.
 3. The game "Bettor's Choice" described on page T 5 may be adapted for division. Use cards for basic division facts. The numbers 0 and 10 would not be used.
- Have children complete diagrams as suggested on page T 193. Include new division facts presented in Unit 16.

Working Together: For Ex. 1 and 2, the sharing and the grouping pictures are completed. Develop how the quotient and the remainder are found from the picture. Point out where the quotient and remainder are written in the division notation. Ex. 3 and 4 are similar, except that children must complete each picture before recording the division. Have children explain their answers on the board.

Ex. 5 and 6 examine whether children know that counting the subtractions names the quotient and that the last difference names the remainder. Ex. 7-10 deal with the skill of knowing how subtraction leads to the quotient and remainder. Ask the following questions.

"What number do we start with?"

"What number is subtracted each time?"

"How do you know when the last subtraction is completed?"

"What do you count to find the quotient?"

"How do you know what the remainder is?"

Exercises: The children may choose any method reviewed in *Working Together* to find the quotients. Ensure that each child understands Ex. 15. The squares represent letter tiles on a game board. Have the children complete the division on each tile and then refer to the code provided. This enables them to discover the letters for the tiles and find the words the tiles form.

Assessment

Find the quotient and the remainder.

1. $3 \overline{) 14}$ R 2

2. $4 \overline{) 27}$ R 3

3. $8 \overline{) 61}$ R 5

4. $9 \overline{) 56}$ R 2

LESSON OUTCOME

Use the standard algorithm to divide, one-digit divisors, and one-digit quotients with remainders

Prerequisite Skills

Use multiplication to divide; subtract a two-digit number from a two-digit number

Checking Prerequisite Skills

Divide. Write the multiplication fact you use.

1. $6 \overline{)36}$ 2. $7 \overline{)42}$ 3. $9 \overline{)27}$
 $6 \times 6 = 36$ $7 \times 6 = 42$ $9 \times 3 = 27$
 Subtract.

4. $\begin{array}{r} 50 \\ - 45 \\ \hline 5 \end{array}$ 5. $\begin{array}{r} 71 \\ - 64 \\ \hline 7 \end{array}$
 6. $\begin{array}{r} 28 \\ - 24 \\ \hline 4 \end{array}$ 7. $\begin{array}{r} 20 \\ - 18 \\ \hline 2 \end{array}$

Using Multiplication to Divide, Non-Zero Remainders

There are 60 cards. The 8 players get the same number of cards. As many cards are used as possible. How many cards does each player get?

Divide $8 \overline{)60}$

Study this table.

Number of cards for each player	1	2	3	4	5	6	7	8	9
Number of cards in all	8	16	24	32	40	48	56	64	72

Each player can get 7 cards.

There are not enough cards for each player to get 8.

Write

$\begin{array}{r} 7 \\ 8 \overline{)60} \\ \underline{56} \\ 4 \end{array}$

7 cards to each player
 60 cards in all
 8×7 or 56 cards used
 $60 - 56$ or 4 cards left over

8 players get 7 cards.
 4 cards are left over.

Here is another way to show that the quotient is 7 and the remainder is 4.

$\begin{array}{r} 7 \text{ R } 4 \\ 8 \overline{)60} \\ \underline{56} \\ 4 \end{array}$



304

LESSON ACTIVITY

Before Using the Pages

- For a few division exercises similar to the ones shown, have the children write the multiplication fact they would use for each exercise, and then complete the division. They may need to refer to the completed multiplication table from page 300 or page 276. Show the solutions on the board.

$5 \overline{)40}$ $9 \overline{)36}$ $8 \overline{)56}$

Using the Pages

- Dealing cards for a card game can involve division with remainders. This situation is presented in the worked example. A multiplication table is provided to show that if as many cards as possible are used, there are enough cards for each player to get seven cards. The multiplication fact that helps with this problem is $\begin{array}{r} \times 7 \\ 8 \overline{)56} \end{array}$.

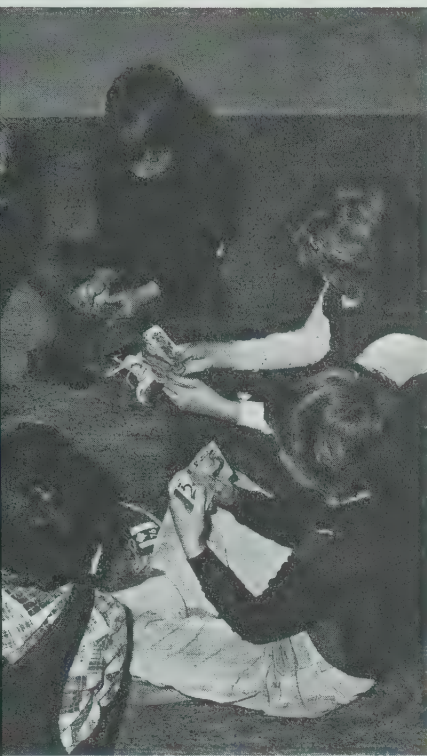
Explain how this fact is shown in the division notation at

the bottom right of the page. Develop how the remainder found.

Working Together: These exercises lead the children toward showing division in the form of the division algorithm. Guide them carefully through a discussion of each exercise on the board. Use similar exercises as needed. For Ex. 3, discuss that it is necessary to think of the multiplication fact in the form $\begin{array}{r} \times ? \\ 6 \overline{)30} \end{array}$ for which the product is nearest to, but less than,

34. Have the children examine the table provided. Point out that a product of 36 is too great and that the nearest product is 30. Thus, the multiplication fact to use is $\begin{array}{r} \times 5 \\ 6 \overline{)30} \end{array}$. Some children may need to refer to a multiplication table for help with Ex. 3-10.

Exercises: Have the children refer to a multiplication table for assistance when necessary. When they have finished the exercises, you may wish to select one or two exercises and have the children find the quotient and remainder using



Working Together

For each question, find the best answer in the table.

- Which multiplication fact would you use for $6\overline{)34}$? $6 \times 5 = 30$
- Which multiplication fact would you use for $4\overline{)29}$? $4 \times 7 = 28$

Which multiplication fact would you use for each of these?

- $7\overline{)30}$ $7 \times 4 = 28$
 - $5\overline{)38}$ $5 \times 7 = 35$
 - $9\overline{)23}$ $9 \times 2 = 18$
- Give the quotient and remainder to complete each division.
- $5\overline{)44}$ 8 R 4
 - $6\overline{)22}$ 3 R 4

Divide. Show the quotient and remainder.

- $8\overline{)36}$ 4 R 4
- $6\overline{)56}$ 9 R 2
- $7\overline{)40}$ 5 R 5

Exercises

Divide. Show the quotient and remainder.

- $6\overline{)33}$ 5 R 3
- $4\overline{)15}$ 3 R 3
- $7\overline{)60}$ 8 R 4
- $4\overline{)30}$ 7 R 2
- $8\overline{)45}$ 5 R 5
- $5\overline{)22}$ 4 R 2
- $9\overline{)59}$ 6 R 5
- $7\overline{)50}$ 7 R 1
- $5\overline{)29}$ 5 R 4
- $6\overline{)44}$ 7 R 2
- $3\overline{)20}$ 6 R 2
- $9\overline{)39}$ 4 R 3
- $5\overline{)88}$ 17 R 1
- $8\overline{)67}$ 8 R 3
- $9\overline{)40}$ 4 R 4
- $6\overline{)39}$ 6 R 3
- $5\overline{)36}$ 7 R 1
- $8\overline{)67}$ 8 R 3
- $9\overline{)64}$ 7 R 1
- $4\overline{)19}$ 4 R 3
- $6\overline{)50}$ 8 R 2
- $9\overline{)64}$ 7 R 1
- $8\overline{)35}$ 4 R 3
- $7\overline{)75}$ 10 R 5
- $4\overline{)19}$ 4 R 3
- $6\overline{)50}$ 8 R 2
- $9\overline{)64}$ 7 R 1
- $8\overline{)35}$ 4 R 3
- $6\overline{)26}$ 4 R 2
- $7\overline{)68}$ 9 R 5
- $8\overline{)28}$ 3 R 4
- $5\overline{)49}$ 9 R 4

305

RELATED ACTIVITIES

• Children may practice division with remainders by playing a game using a game board similar to the one shown, a marker for each player, and a die marked 3, 4, 5, 6, 7, 8. Markers are placed at "Start". Each player, in turn, rolls the die, finds the remainder when 8 is divided by the number shown on the die, and advances her/his marker that number of spaces. For example, if the die shows 3, the remainder for $3\overline{)8}$ is 2, and the player advances her/his marker to "16". In the next round, this player would divide 16 by the number shown on the die. The first player to reach "Finish" is the winner. Vary the game by changing the numerals on the die.

18	11	25	14
go back 2	miss a turn	17	go ahead 1
26	22	29	12
15		21	27
10	FINISH	28	19
23	go back 4	13	go back 3
START 8	20	16	24

repeated subtraction. This would show that the process is much shorter when multiplication is used.

Ex. 4 $4\overline{)30}$

(a)	30	(b)	7 R2
	$- 4$		$4\overline{)30}$
	26		$\underline{28}$
	$- 4$		2
	22		
	$- 4$		
	18		
	$- 4$		
	14		
	$- 4$		
	10		
	$- 4$		
	6		
	$- 4$		
	2		

Assessment

Divide. Show the quotient and remainder.

- $8\overline{)71}$ 8 R 7
- $7\overline{)36}$ 5 R 1
- $4\overline{)29}$ 7 R 1
- $2\overline{)17}$ 8 R 1

OBJECTIVE

Write a concluding statement for a word problem

Vocabulary

concluding statement

RELATED ACTIVITIES

- Prepare cards showing one problem on each card. Have children write solutions on the cards without writing the concluding statements. Have the children exchange cards and write the concluding statement of the solution for the problem on the card they have received.

The Concluding Statement

Your solution to a problem is complete when you give the **concluding statement**.

Example: Darwin, Olive, and Nora spend 15¢ for 27 beads. They share the beads equally. How many beads does each get?

To solve the problem divide 27 by 3.

$$\begin{array}{r} 9 \\ 3 \overline{)27} \end{array}$$

This is the concluding statement.

Darwin, Olive, and Nora each get 9 beads.

1. The ten children together were 380 kg.

3. The bottles holding 100mL cost \$0.10 more.
2. The girl ran 400m.

4. The amount of the table covered by the place mat was 1200cm².

The questions below were taken from some problems. The answers are given in the box, but they are mixed up. Match each question with an answer and write a concluding statement for the problem.

Questions:

Answers:

1. How heavy were the 10 children together?

3. How much more did the bottle holding 100 ml cost?

5. How tall was the stack of 400 ml bottles?

7. How hot was it when they drove the 10 km to the beach?
2. How far did the girl run?

4. How much of the table was covered by the place mat?

6. How much water did Joshua use for his bath?

8. What time was it when Gretchen put the dime into the parking meter?

9. How much more syrup could you buy for an extra \$0.50?

100 ml 380 kg

120 cm 100 l

11:18

30°C

400 m

1200 cm²

\$0.10

PROBLEM SOLVING

5. The stack of 400mL bottles was 120cm tall.

306 7. It was 30°C when they drove the 10km to the beach.
6. Joshua used 100L of water for his bath.

8. It was 11:18 when Gretchen put the dime into the parking meter.

9. You could buy 100mL more syrup for an extra \$0.50.

LESSON ACTIVITY

Using the Page

- During the year, you may have emphasized that every word problem must have a concluding statement (a sentence that answers the question). The lesson on page 306 reviews that practice. Read the worked example with the children. Discuss that the concluding statement answers the question in the word problem, "How many beads does each get?"

Review the directions for the exercises to ensure that the children understand what is required. Complete Ex. 1 with the children. Discuss why an answer such as 100 mL is not a reasonable answer for this question. You may wish to spend a few moments reviewing the symbols shown in the answers given.

Remind the children that now the symbol L is used for litres and the symbol mL for millilitres.

Checking Up

Write the multiplication fact that can be used to find the quotient. Complete the division fact.

1. $9 \overline{)54}$ $\begin{array}{r|l} \times & 4 \\ 9 & 36 \end{array}$ $\begin{array}{r|l} \times & 5 \\ 9 & 45 \end{array}$ $\begin{array}{r|l} \times & 6 \\ 9 & 54 \end{array}$

Divide. Write the multiplication fact you use.

2. $6 \overline{)48}$ $6 \times 8 = 48$
3. $8 \overline{)32}$ $8 \times 4 = 32$

Divide.

4. $6 \overline{)36}$ 6
5. $9 \overline{)27}$ 3
6. $7 \overline{)21}$ 3
7. $6 \overline{)24}$ 4
8. $7 \overline{)63}$ 9
9. $8 \overline{)40}$ 5
10. $9 \overline{)72}$ 8
11. $8 \overline{)64}$ 8

Complete the division for each.

12. $3 \overline{)13}$ 4R
13. $4 \overline{)11}$ 2R 3
14. $6 \overline{)16}$ 2R 4

Write the multiplication fact that helps you find the quotient and remainder. Complete the division.

15. $8 \overline{)28}$ 3R 4 $\begin{array}{r|l} \times & 3 \\ 8 & 24 \end{array}$ $\begin{array}{r|l} \times & 4 \\ 8 & 32 \end{array}$ $\begin{array}{r|l} \times & 5 \\ 8 & 40 \end{array}$

Complete each division. Write the multiplication fact you use.

16. $6 \overline{)44}$ 7R 2 $6 \times 7 = 42$
17. $3 \overline{)16}$ 5R 1 $3 \times 5 = 15$

Divide. Show the quotient and remainder.

18. $4 \overline{)31}$ 7R3
19. $8 \overline{)57}$ 7R1
20. $5 \overline{)34}$ 6R4
21. $3 \overline{)29}$ 9R2
22. $9 \overline{)69}$ 7R6
23. $8 \overline{)53}$ 6R5
24. $9 \overline{)83}$ 9R2
25. $7 \overline{)54}$ 7R5

Show each division and answer the questions.

26. 28 marbles in all.
7 marbles for each player. $7 \overline{)28}$
How many can play? 4
27. 14 cards in all. 5 children share equally. How many cards for each child? $5 \overline{)14}$
How many cards left over? 4

307

OBJECTIVE

Demonstrate an understanding of the concepts and skills presented in this unit

RELATED ACTIVITIES

• The game "My Choice" may be played by children using three sets of numeral cards for 1 to 24. The cards are shuffled and shared by three children. The first child plays a card and the second child plays another card. The third child must say, "Add", "Subtract", "Multiply", or "Divide" and select one card from her/his hand showing the result of performing the operation on the two numbers on the cards played. For example,

$\begin{array}{|c|} \hline 4 \\ \hline \end{array}$ $\begin{array}{|c|} \hline 2 \\ \hline \end{array}$ multiply $\begin{array}{|c|} \hline 8 \\ \hline \end{array}$

$\begin{array}{|c|} \hline 24 \\ \hline \end{array}$ $\begin{array}{|c|} \hline 8 \\ \hline \end{array}$ divide $\begin{array}{|c|} \hline 3 \\ \hline \end{array}$

If the result is correct, the player wins the three cards. If the third player cannot give the correct result, the cards are placed in a discard pile. The third player then plays the first card in the next round, and the first and second players of the first round now become the second and third players of the new round. At the end of the game the player with the most cards is the winner.

Comments

Activities and games in Units 9 and 16 may provide drill for division facts. Since division is the inverse of multiplication, reviewing multiplication facts is important to help with the division facts as well as to reinforce the relationship between multiplication and division. Methods for drilling multiplication facts may be found in Units 8 and 15.

Determine whether errors are due to difficulties with division, with multiplication, or with relating division and multiplication. Then decide which aspect of division or of multiplication is causing the difficulty. Provide assistance as needed.

If children have difficulty understanding the concept of a remainder, they may benefit from more practice with materials, then with drawings, and then with ideas for exercises suggested in the lessons, activities, and games on the appropriate pages in the unit.

Encourage children to check answers they are not certain about by using a drawing, a number line, or repeated subtraction.

Skills	Exercises	Related Pages
relate multiplication and division, no remainders	1	T 324-T 325
use multiplication to divide, no remainders	2, 3	T 324-T 325
find quotients, no remainders	4-11	T 326-T 329
use pictures to find quotients and remainders	12, 13	T 332-T 333
use subtraction to find quotients and remainders	14	T 332-T 333
relate multiplication and division with remainders	15	T 334-T 335
use multiplication to divide with remainders	16, 17	T 334-T 335
find quotients and remainders	18-25	T 334-T 335
solve division problems	26, 27	

Using the Pages

The table for the basic addition facts is shown at the top of page 308. Ex. 1-50 involve some of the basic addition facts. These exercises provide practice to be used at different times and in various ways to encourage speed and accuracy.

Discuss the diagram at the top right of page 308. Explain how to use the table to find the sums for basic addition facts.

Before beginning the exercises, have the children write the numbers for the exercises on a sheet of paper. Have them record only the answers. Children who do not know the answers may refer to the table.

As suggested in the thought clouds, the children could be timed as they complete the exercises. This could be accomplished by writing the number of minutes and seconds on the board continually as the children are working on the exercises. When each child finishes the exercises, he/she records the last time written on the board. Then have the children mark their answers.

Encourage each child to increase the number of exercises he/she is able to complete correctly within the given time whenever the page is used.

The addition table on page 308 is used for the basic subtraction facts on page 309. Ex. 1-50 involves some of the basic subtraction facts. These exercises can be used for practice on different occasions.

Use the information and the diagrams at the top of page 309 to explain how the addition table on page 308 can be used to find the difference for a basic subtraction fact.

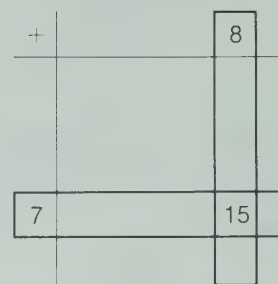
Discuss why the addition table can help with basic subtraction facts. Lead the children to realize that because of the relationship between addition and subtraction, one table can be used for the basic facts for both addition and subtraction.

You may wish to have the children record the subtraction facts that they complete incorrectly. This list could be referred to individually for review, or a child could give her/his list to another who could ask the first child for the answers for these facts.

This addition table shows the basic addition facts.

+	0	1	2	3	4	5	6	7	8	9
0	0	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9	10
2	2	3	4	5	6	7	8	9	10	11
3	3	4	5	6	7	8	9	10	11	12
4	4	5	6	7	8	9	10	11	12	13
5	5	6	7	8	9	10	11	12	13	14
6	6	7	8	9	10	11	12	13	14	15
7	7	8	9	10	11	12	13	14	15	16
8	8	9	10	11	12	13	14	15	16	17
9	9	10	11	12	13	14	15	16	17	18

Use it like this for $7 + 8$.



Write $7 + 8 = 15$.

Add. Use the table if you need to.

How long does it take you to do these exercises?

How many can you do in one minute?

1. $1 + 3 = 4$	2. $2 + 2 = 4$	27. $3 + 2 = 5$	28. $6 + 1 = 7$	29. $2 + 8 = 10$	30. $3 + 3 = 6$
3. $4 + 1 = 5$	4. $4 + 6 = 10$	31. $8 + 1 = 9$	32. $1 + 7 = 8$	33. $0 + 3 = 3$	34. $3 + 7 = 10$
5. $5 + 2 = 7$	6. $2 + 6 = 8$	35. $6 + 3 = 9$	36. $4 + 4 = 8$	37. $1 + 5 = 6$	38. $4 + 3 = 7$
7. $6 + 0 = 6$	8. $7 + 2 = 9$	39. $9 + 2 = 11$	40. $8 + 6 = 14$	41. $7 + 7 = 14$	42. $9 + 8 = 17$
9. $2 + 1 = 3$	10. $5 + 5 = 10$	43. $7 + 4 = 11$	44. $3 + 9 = 12$	45. $5 + 7 = 12$	46. $9 + 4 = 13$
11. $1 + 9 = 10$	12. $2 + 4 = 6$	47. $8 + 8 = 16$	48. $6 + 9 = 15$	49. $4 + 8 = 12$	50. $7 + 8 = 15$
13. $5 + 4 = 9$	14. $3 + 5 = 8$				
15. $8 + 5 = 13$	16. $4 + 9 = 13$				
17. $7 + 9 = 16$	18. $6 + 5 = 11$				
19. $6 + 6 = 12$	20. $5 + 9 = 14$				
21. $8 + 7 = 15$	22. $9 + 9 = 18$				
23. $3 + 8 = 11$	24. $7 + 5 = 12$				
25. $6 + 7 = 13$	26. $8 + 4 = 12$				

Subtract. Use the addition table if you need to.

How long does it take you to do these exercises?

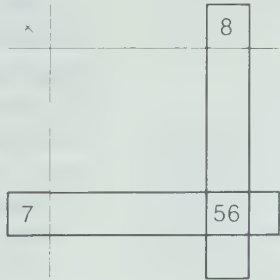
How many can you do in one minute?

1. $7 - 5 = 2$	2. $9 - 2 = 7$	27. $8 - 6 = 2$	28. $5 - 4 = 1$	29. $4 - 2 = 2$	30. $6 - 3 = 3$
3. $4 - 3 = 1$	4. $8 - 7 = 1$	31. $7 - 1 = 6$	32. $4 - 4 = 0$	33. $5 - 2 = 3$	34. $9 - 4 = 5$
5. $5 - 1 = 4$	6. $5 - 0 = 5$	35. $10 - 2 = 8$	36. $10 - 9 = 1$	37. $11 - 6 = 5$	38. $10 - 5 = 5$
7. $9 - 6 = 3$	8. $8 - 3 = 5$	39. $13 - 7 = 6$	40. $15 - 6 = 9$	41. $12 - 8 = 4$	42. $16 - 7 = 9$
9. $6 - 2 = 4$	10. $7 - 4 = 3$	43. $11 - 9 = 2$	44. $13 - 4 = 9$	45. $15 - 8 = 7$	46. $11 - 3 = 8$
11. $10 - 6 = 4$	12. $10 - 3 = 7$	47. $18 - 9 = 9$	48. $14 - 7 = 7$	49. $12 - 3 = 9$	50. $14 - 9 = 5$
13. $11 - 8 = 3$	14. $12 - 9 = 3$				
15. $17 - 8 = 9$	16. $11 - 5 = 6$				
17. $15 - 9 = 6$	18. $12 - 4 = 8$				
19. $13 - 8 = 5$	20. $14 - 5 = 9$				
21. $11 - 7 = 4$	22. $12 - 6 = 6$				
23. $16 - 8 = 8$	24. $15 - 7 = 8$				
25. $12 - 5 = 7$	26. $14 - 8 = 6$				

This multiplication table shows basic multiplication facts.

×	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9
2	2	4	6	8	10	12	14	16	18
3	3	6	9	12	15	18	21	24	27
4	4	8	12	16	20	24	28	32	36
5	5	10	15	20	25	30	35	40	45
6	6	12	18	24	30	36	42	48	54
7	7	14	21	28	35	42	49	56	63
8	8	16	24	32	40	48	56	64	72
9	9	18	27	36	45	54	63	72	81

Use it like this
for 7×8 .



Write $7 \times 8 = 56$.

Using the Pages

The table for basic multiplication facts is shown on page 310. Ex. 1-50 provide practice that can be used in various ways. Adapt the methods for using the page to challenge each child.

Use the diagram at the top right of page 310 to explain how the table shows the products for basic multiplication facts.

Encourage speed and accuracy as suggested for pages 308-309. Children who need help remembering some of the products can refer to the multiplication table. You may wish to challenge the children to complete as many exercises as possible without referring to the table, and then use the table to find the others.

The multiplication table on page 310 is used for basic division facts on page 311. Ex. 1-66 involve some of the basic division facts. These exercises may be used in different ways for division practice. Ensure that the practice provides a challenge for each level of speed and accuracy.

Discuss the information and the diagram at the top of page 311. Develop how the multiplication table on page 310 can help with basic division facts. Establish that one table can be used for basic multiplication facts and basic division facts because of the relationship between multiplication and division. You may wish to show this relationship with objects, drawings, or a number line.

Encourage speed and accuracy as suggested for pages 308-309. The multiplication table on page 310 can be used by children who need help in finding the quotients.

Page 311 may be used for an oral drill. One child could read the exercises. Another child or other children would write the answers. Then the caller reads the exercises in the same order, and a child states the answers as they mark their work.

If the children are to be timed as they complete the exercises, encourage them to decrease the length of time and to increase the number of correct answers on each occasion when the page is used. Each child could record the time and the number of correct answers on two separate graphs to keep track of her/his progress.

Multiply. Use the table if you need to.

1. 2×4 8

3. 2×3 6

5. 4×3 12

7. 3×6 18

9. 9×2 18

11. 5×5 25

13. 8×3 24

15. 7×4 28

17. 6×5 30

19. 5×7 35

21. 7×7 49

23. 9×7 63

25. 6×9 54

2. 7×1 7

4. 3×3 9

6. 6×2 12

8. 5×3 15

10. 2×8 16

12. 6×4 24

14. 3×9 27

16. 4×5 20

18. 9×4 36

20. 8×5 40

22. 5×9 45

24. 8×8 64

26. 8×9 72

27. 3×2 6

29. 4×2 8

31. 5×2 10

33. 2×7 14

35. 3×8 24

37. 7×3 21

39. 4×9 36

41. 6×6 36

43. 6×8 48

45. 7×9 63

47. 7×9 63

28. 1×4 4

30. 2×4 8

32. 4×4 16

34. 2×6 12

36. 5×4 20

38. 7×4 28

40. 7×5 35

42. 6×8 48

44. 9×5 45

46. 7×6 42

48. 9×8 72

50. 9×6 54

How long does it take you to do these exercises?

How many can you do in one minute?

Divide. Use the multiplication table if you need to.

1. $10 \div 2$ 5

3. $6 \div 2$ 3

5. $4 \div 1$ 4

7. $9 \div 3$ 3

9. $27 \div 9$ 3

11. $15 \div 3$ 5

13. $24 \div 3$ 8

15. $49 \div 7$ 7

17. $40 \div 5$ 8

19. $32 \div 8$ 4

21. $45 \div 5$ 9

23. $54 \div 9$ 6

25. $72 \div 8$ 9

2. $8 \div 4$ 2

4. $12 \div 6$ 2

6. $16 \div 8$ 2

8. $18 \div 2$ 9

10. $18 \div 6$ 3

12. $20 \div 5$ 4

14. $28 \div 7$ 4

16. $30 \div 5$ 6

18. $35 \div 7$ 5

20. $42 \div 6$ 7

22. $64 \div 8$ 8

24. $56 \div 8$ 7

26. $63 \div 7$ 9

27. $2 \overline{)12}$ 6

29. $7 \overline{)14}$ 2

31. $2 \overline{)4}$ 2

33. $7 \overline{)7}$ 1

35. $5 \overline{)10}$ 2

37. $3 \overline{)12}$ 4

39. $3 \overline{)21}$ 7

41. $3 \overline{)18}$ 6

43. $5 \overline{)15}$ 3

45. $4 \overline{)20}$ 5

47. $4 \overline{)16}$ 4

49. $7 \overline{)21}$ 3

51. $5 \overline{)35}$ 7

53. $7 \overline{)42}$ 6

55. $4 \overline{)32}$ 8

57. $8 \overline{)48}$ 6

59. $9 \overline{)45}$ 5

61. $6 \overline{)36}$ 6

63. $6 \overline{)54}$ 9

28. $4 \overline{)12}$ 3

30. $2 \overline{)16}$ 8

32. $9 \overline{)18}$ 2

34. $2 \overline{)8}$ 4

36. $2 \overline{)14}$ 7

38. $3 \overline{)6}$ 2

40. $4 \overline{)28}$ 7

42. $5 \overline{)25}$ 5

44. $6 \overline{)24}$ 4

46. $3 \overline{)27}$ 9

48. $8 \overline{)24}$ 3

50. $4 \overline{)24}$ 6

52. $9 \overline{)36}$ 4

54. $6 \overline{)48}$ 8

56. $8 \overline{)40}$ 5

58. $6 \overline{)30}$ 5

60. $4 \overline{)36}$ 9

62. $9 \overline{)81}$ 9

64. $7 \overline{)56}$ 8

65. $9 \overline{)72}$ 8

66. $9 \overline{)63}$ 7

How long does it take you to do these exercises?

How many can you do in one minute?

Theme for Unit 1: The Supermarket

The supermarket plays an important part in the lives of many children. It is a source for exploring social concepts as well as for developing mathematics and language skills.

The Role of the Supermarket

Discuss with the children the role of the supermarket in your community. Some communities rely completely on the local supermarket and the farmers' market for all their food. Others use the supermarket to supplement home-grown foods. People in communities without a supermarket may travel long distances to buy food. You may wish to discuss questions similar to the following.

"How often does your family shop at the supermarket?"

"What does your family buy at the supermarket?"

"What are the advantages of shopping at the supermarket instead of shopping at several small stores?"

"What are the disadvantages of shopping at the supermarket instead of shopping at several small stores?"

Visiting the Supermarket

Arrange a class visit with the manager of a local supermarket. Many stores welcome class groups. They may suggest a time when they are not so busy as usual and could provide an opportunity for the children to meet the staff and see the services offered by the store.

Before the visit, encourage the children to share their knowledge about supermarkets. Record this information on a chart. Then make a chart about what they wish to find out by visiting the supermarket. Assist the children in formulating precise questions. Decide which staff members would be appropriate to answer the questions. Write each question on a card and record who they wish to ask for the answer. Assign a child to ask each question.

After the visit, record the answers on the original chart. You may wish to use this information to develop a class book describing the visit to the supermarket. The children may also wish to express their thanks to the people working at the supermarket. This would be an opportunity for writing a class letter or individual letters.

To further reinforce the information gained from the visit, set up a store in the classroom. The children may bring empty containers from home. Perishable items, such as meat, fruit, and vegetables, may be made with modeling material or paper during an art lesson. The children could use real money at the checkout counter or play money made from copies of pages T351 and T352 for the experience of making change. Encourage the children to play different roles in the class supermarket.

Mathematics in the Supermarket

The supermarket offers many ideas for providing real experiences in mathematics for the children. Try some of the following with your class.

Sizes of Containers

Explore the range of sizes of containers for a variety of products. Discuss which products have a greater range of sizes than other products. Compare the different sizes for detergent

and for toothpaste. Ask questions similar to the following.

"Why are different sizes available?"

"How are these sizes related?"

"What names are given to different sizes?"

"What is the capacity of each size?"

Make a chart showing a set of containers arranged from largest to smallest.

Packaging

Have the children discuss how items are packaged in the fruit and vegetable department. Ask the following questions and record the answers on a chart.

"Which items are sold by mass?"

"Which items are sold individually?"

"Which items are sold in small groups?"

"Which items are sold by the dozen?"

Discuss why there are differences in the prices of items sold individually and in larger quantities.

Comparative Shopping

Food stores compete for customers by offering special prices on individual items. A store may claim to have cheaper prices than other stores. To test this idea, have the children list six staple items by brand name and size. Choose the newspaper advertisements for three different stores. Record the prices of the selected items each week for the three stores. Continue the study for at least four weeks. Discuss whether one store had cheaper prices over a period of time. Discuss whether the results would be the same after two months or after one year.

Planning Meals

Discuss nutrition and the importance of eating meat, vegetables, fruit, whole grains, and dairy products each day. Ask each child to plan a nutritious breakfast, lunch, and dinner. Have the children use newspaper advertisements to calculate the cost of each meal.

Mapping a Supermarket

After the visit to the supermarket, discuss the arrangement of items in the supermarket. Have the children consider how the arrangement helps shoppers. Point out that there are the following different kinds of storage areas in the supermarket.

- compartments for frozen foods
- cooled racks for meat and dairy products
- open cases for fruit and vegetables
- shelves for cans and packages
- display racks for special items

Have the children list items found in each storage area. Ask them to suggest other ways of arranging items in the supermarket. They may enjoy discussing the effect of arranging products in alphabetical order, by size, or by color.

Ask about the special care that must be taken when displaying some items. The children may suggest:

- a. Avoid breaking bottles because of stacking too many or placing them too high on the shelves.
- b. Display delicate fruit or vegetables individually to prevent bruising.
- c. Keep leafy vegetables moist to prolong freshness.
- d. Keep items from hanging over shelves and being knocked off by shoppers.

Supply each child with a large sheet of newsprint to draw a map of the supermarket. Remind the children to show the display areas and their arrangement. Compare the maps. Have

The children share the problems they had to solve when drawing the map.

Attracting Customers

To stay in business, supermarkets must compete for customers by supplying quality products and offering special services. Assist the children in realizing that the consumer has the responsibility of assessing these services which add to the cost of food. Have the children list the techniques that supermarkets use to attract customers. They may suggest the following.

- | | |
|----------------------|----------------------|
| bright color schemes | interesting displays |
| long store hours | contests |
| special prices | lucky draws |
| discount coupons | parking space |

Discuss the advantages and disadvantages of each technique. Ask which services the children think are necessary and which they think are not necessary.

Foods from Near and Far

Most supermarkets sell foods from all over the world. Encourage the children to read the labels on packaged food. Record the names of foods and the country where each is from on a large map. List the foods according to those produced in Canada and those imported into Canada. Discuss the types of food that are imported year-round and those that are imported only during part of the year. Then have the children select foods they would like to taste. Arrange an opportunity for them to taste unusual foods or foods that are common but can be used in unusual ways. Children may enjoy sharing their reactions to the foods.

The potato is an example of a food that can be used in different ways. It can be boiled, mashed, baked, fried, or deep fried. It can also be used to make bread, stuffing, pancakes, or candy. Plan some cooking experiences in the classroom so that children may taste potatoes used in unusual ways. Have each child make a potato cookbook to share with her/his family.

Potato Candy

- 1 medium-sized potato
- 750 mL to 875 mL icing sugar, sifted
- 250 mL to 375 mL shredded coconut
- 5 mL vanilla
- 2 squares unsweetened chocolate, melted

Cook the potato in unsalted boiling water until soft. Drain and mash with a fork. Work in sifted icing sugar with a wooden spoon. The amount of icing sugar will depend on the size of the potato.

Mix in coconut and vanilla. The mixture will look like a thick icing. Shape into two rolls 3 cm in diameter. Wrap in waxed paper and chill until firm (about 2 hours).

Coat with melted chocolate over the rolls to coat completely. Dip in coconut and rewrap. Store in the refrigerator until ready to use.

Serve in thin slices. The yield is about 30 slices.

Theme for Unit 2: Fairy Tales

Fairy tales are a source of inspiration for creative and expressive thought. The elements of magic and fantasy in fairy tales encourage children to explore their own imaginations and private worlds. Moreover, fairy tales provide information about values and life styles of various cultures and of the past.

To help the children enjoy and understand the characteristics of fairy tales, encourage them to become acquainted with many fairy tales representing a variety of cultures and authors. As well as providing an opportunity for the children to read daily from a collection of fairy tales, read to them from the collection each day.

Elements of a Fairy Tale

To enable the children to discover how fairy tales are different from real-life stories, they will need to become familiar with many fairy tales. Have each child read at least three fairy tales. Read at least three fairy tales to the class. Then help the children list the characteristics that the stories have in common. This list may include the following ideas.

- a. The stories began long ago.
- b. Birds and animals talk in the stories.
- c. Things may be bigger or smaller than in real life.
- d. Fairies, witches, and other characters are often involved in the stories.
- e. There were usually good characters and evil characters.
- f. The stories have happy endings.
- g. The events in the stories did not really happen.

As the children become more involved with the fairy tales, help them add other characteristics to the list.

Why Are There Fairy Tales?

To make the children aware of why fairy tales were created, discuss questions similar to the following with the class or with small groups.

“Why are stories that began hundreds of years ago still popular today?”

“Why do we find stories that didn’t actually happen so enjoyable?”

“What place does fantasy have in daily life?”

“What parts do fairies have in fairy tales?”

“What part do witches have in fairy tales?”

“What part do giants have in fairy tales?”

“Why is it important for fairy tales to have happy endings?”

Establish that children realize that fairy tales have been a source of pleasure and recreation in many cultures for a long time. Help the children understand that fantasy is often helpful in dealing with reality. Moreover, fairy tales show values distinctive to a culture.

Favorite Fairy Tales

As the children read fairy tales and hear them read by the teacher, they are exposed to a variety of fairy tales. Encourage the children to develop their own tastes in selecting stories and to use discrimination in assessing their enjoyment of fairy tales.

On a chart, record the titles of fairy tales the children read. Draw three bars beside each title as shown. Display the chart for all the children to use. Add to the graph during the time allotted to this theme.

Theme for Unit 3: The School

Although many children in the third grade take school for granted, it does offer many opportunities for exploration and study. The children may be helped to understand that the school is a community and that each child has a special place within that community.

Tour of the School

Begin studying the school by arranging a tour of the school. Ask the children to consider each of the following questions during the tour.

- “What materials are used to build a school?”
- “How are the rooms and hallways arranged?”
- “How much space is used for the various areas?”
- “What are the different roles of the people in the school?”

The Physical Aspects of the School

Many types of building materials are used in constructing a school. Have the children identify and list the materials used in the school. If possible, provide samples of these building materials to enable the children to appreciate their texture and their mass. Discuss questions similar to the following.

- “In what order are these materials put together to build a school?”
- “Which materials burn and which do not burn?”
- “Which materials are easily broken and scratched?”
- “Which materials are man-made and which materials are natural?”
- “Which materials are used for constructing a school but are not used for building a house?”

Mapping a Classroom

Have the children name the objects in the classroom and point out their positions. Explore ways of showing these objects on a map of the classroom. Emphasize the positions and relative sizes of the objects. Introduce the children to the term *scale*. Ask how a scale could help in the preparation of a classroom map.

Supply each child with a large sheet of paper for drawing a map of the classroom. Encourage the children to think about how they wish to show the objects in the room. The maps would make an interesting display.

After the maps are completed, have the children share their maps as for representing objects on the maps. Have them discuss how they overcame problems they encountered in drawing the maps. Ask how they are able to make a map that is easy to read.

Mapping the School

Make a list of all the classrooms, hallways, and other areas of the school. Remind the children about what they learned by mapping a map of their classroom. Review the concept of a scale and how it is used in maps. Choose a scale of 1 cm for 1 m. Have the children work in pairs to measure the approximate size of each room on one floor of the school and then outline this on graph paper. Remind them to label each room they measured. Have them cut out each outline and paste it in position on a large sheet of paper to make a map of that floor of the school.

Making a Model of a Classroom

Have the children discuss how to make a model of the classroom. You will need boxes, paint, yarn, wallpaper scraps, fabric scraps, carpet scraps, and cardboard. After these materials have been collected, have children work in groups of two or three to make a model of a classroom. Display these models with comments written by the “architects”.

Roles in the School

The children should realize that many people perform different functions in the operation of a school. Have them list the people who contribute in their school. The list may include:

principal	guidance counselor
vice-principal	custodian
secretary	librarian
nurse	teacher

Discuss the role of each person on the list.

You may wish to have several of these persons visit the classroom to answer questions that the children wish to ask. The information gained from the questions about the role of each person may then be written as a report. The reports may be presented in a class book.

Role of the Student

Challenge the children to think about the role of students within the school. Ask whether this role changes as they become older. Suggest that after recording her/his own ideas, each child talk with a younger student and with an older student. Ask whether the two students have similar points of view.

School Materials

Over a period of a week, have the children list all the materials they use in their learning experiences. Page 55 of *Starting Points in Mathematics 3* may initiate a discussion of the following questions.

“Are you surprised by how many different materials you use at school?”

“Which materials do you use without any other materials?”

“Which materials do you use together?”

“Which materials do you use at home as well as at school?”

School Activities

When the children are discussing their role as students, they often suggest that they go to school to learn. Lead them to understand that learning takes place through a variety of experiences. Discuss how the activities of a school day relate to learning. Lead the children to realize that art, physical education, and music contribute to their learning as well as language, mathematics, and social studies.

Out-of-school Activities

School takes only a part of a child's day. Ask how the children use the remainder of the day. Encourage them to discuss the activities they enjoy before and after school. They may mention clubs that they belong to, lessons that they take, and hobbies that they enjoy. Then discuss how the activities they participate in outside of school relate to learning. Develop that not all learning takes place in school. Plan time for the children to share these activities with the class, perhaps by showing things that relate to their lives before and after school.

Theme for Unit 5: Transportation

Many children are fascinated by vehicles. Help them relate different vehicles to their own lives. Although advanced forms of transportation make life easier in some ways, they also cause new environmental problems. It is important for children to be aware of these problems and to begin thinking of possible solutions.

Classifying Vehicles

Have the children collect pictures of as many vehicles as possible. Have them paste each picture on a separate sheet of paper and write the name of the vehicle. Have the children put the sheets together to form a book. Discuss the ways of classifying vehicles according to their uses.

Make a chart with the three headings shown.

People	Freight	Services

List the vehicles under the one or more headings that apply. Discuss the vehicles that appear in more than one column. Help the children appreciate the desirability of vehicles that have more than one use.

Ask the following questions about each of the three classifications in the chart.

People

- “Which of these vehicles are used for recreation?”
- “Which vehicles make the most efficient use of fuel?”
- “Which of these kinds of transportation have you used?”
- “Which of these kinds of transportation is fastest (slowest)?”
- “Which vehicles are the most comfortable?”
- “Which vehicles can transport the most people?”
- “Which vehicles can transport only a few people?”

Freight

- “Which vehicles are used for transporting freight long distances?”
- “Which is the most expensive way to move freight? Why?”
- “How are goods packed for transport in each vehicle?”
- “What kinds of vehicles are available for transporting freight in your community?”
- “What special training is needed to operate these vehicles?”

Services

- “What colors are used on each service vehicle?”
- “What special clothes are worn by the operators of each vehicle?”
- “Which vehicles do you see on public roads?”
- “Why are some vehicles not allowed on public roads?”
- “What safety precautions are followed by the operators of these vehicles?”
- “How many people are required to operate each vehicle?”

Solving Traffic Problems

Help the children identify traffic problems in the community. Lead them to suggest possible solutions for the problems. Discuss how some solutions cause other problems. The following are some examples of factors relating to traffic problems.

Volume

Problem:

At certain times during the day there are too many vehicles on a road. Large traffic jams result, and drivers become impatient. This may result in accidents.

Solutions:

- Encourage people to use car pools to reduce the number of cars on the road.
- Stagger working hours so that people are not all traveling at the same time.
- Reduce the cost of public transportation so that more people use it instead of driving cars.
- Restrict the use of large vehicles at busy times.
- Control access of large industries or offices.

Discuss what further problems are caused when roads are constantly made wider.

Pollution

Problem:

The fuel used for many vehicles emits fumes that pollute the air. These fumes affect people, plants, and animals.

Solutions:

- Reduce the number of vehicles on the road as suggested by controlling the volume of traffic.
- Develop vehicles that use other kinds of energy, such as electricity.
- Require manufacturers to produce vehicles that burn fuel without polluting the air.

No fuel is available in unlimited supply. Discuss how the fuels used in vehicles can be conserved.

Traffic Control

When there are many vehicles on the road at one time, it is necessary to impose controls so that traffic may move efficiently and safely. Discuss the following methods of controlling traffic: signs, lights, and traffic officers.

Signs

Refer to page 81 of *Starting Points in Mathematics 3*. Have the children identify each sign and its purpose. Ask questions similar to the following.

- “What other signs are used in controlling traffic?”
- “How is color used to show the meaning of the sign?”
- “How does the shape of a sign show its purpose?”

Have the children draw traffic signs and state the purpose of each sign.



Traffic lights are used to control both vehicles and people. Ask questions similar to the following.

- “How do the colors of the lights show their meaning?”
- “How do the colors of the lights relate to the colors used in traffic signs?”
- “How are flashing lights used in controlling traffic?”

Traffic Officers

Traffic officers serve different functions; for example, they direct traffic in busy areas during a power failure or at the scene of an accident. Ask these questions.

- “What do traffic officers wear to be noticeable?”
 - “What signals do they use to direct traffic?”
- Traffic officers also enforce traffic laws such as those related to parking or speeding. Ask:
- “Why is it necessary to use these traffic laws?”
 - “What information is provided on a traffic ticket?”
 - “What is the usual penalty for not obeying the traffic laws?”

Controlling Other Forms of Transportation

Boats, airplanes, and trains must also observe traffic procedures. Discuss the following ideas related to each.

Boats

- 1. Floating markers or buoys indicate directions, channels, and harbors.
- 2. Captains must follow strict rules for passing other boats.
- 3. Speeds are posted at a harbor entrance.
- 4. Large boats must have a pilot in charge when they enter or leave a harbor.
- 5. Large boats must dock or anchor in designated places.

Planes

- 1. Air traffic controllers direct the pilot in the takeoff and landing of an airplane.
- 2. The pilot must constantly report the altitude and the speed of an airplane.
- 3. The pilot must follow any instructions from the air traffic controllers for change in the altitude or the speed of the airplane.
- 4. Airport runways are marked with special lights to control direction and speed.

Trains

- 1. Engineers must obey instructions from control centers when traveling through busy sections of a city.
- 2. Lights along the tracks indicate speed and track clearance.
- 3. Trains must signal at a crossing or when approaching a station.

Traffic Safety

Pedestrians as well as drivers are responsible for traffic safety. Review or teach safe practices in regard to the following aspects of safety. Have the children extend the list.

- using traffic lights
- using crosswalks
- selecting safe areas for play
- operating and riding a bicycle

Theme for Unit 8: At the Fair

The fair has played a part in many cultures for centuries. An understanding of the nature of a fair may help children appreciate its place in tradition.

The Elements of a Fair

Discuss the elements of a fair. Have the children list these elements. They may suggest games, rides, candy floss, candy apples, hot dogs, crowds, exhibits, noises, and prizes. Suggest that these elements may be called ingredients. Help them write these ingredients in the form of a recipe. Have children paint a suitable background on mural paper, and then print the recipe in the center.

The Purpose of a Fair

There are references to fairs in many traditional songs and stories. The children may be familiar with the nursery rhyme *Simple Simon* and the folk songs *Oh, Dear! What Can the Matter Be?* and *Come to the Fair*.

Ask the children why they think that fairs have stayed popular for such a long time. List these reasons on a chart. Lead the children to realize that fairs are social events that are both recreational and instructive.

Some fairs have a specific focus such as agriculture or commerce. Some fairs are very large and attract people from great distances; others are small and appeal to local residents. Some fairs last several weeks; others last only a day or two. Discuss these ideas with the children. Then analyze a local fair by considering its duration, size, and appeal.

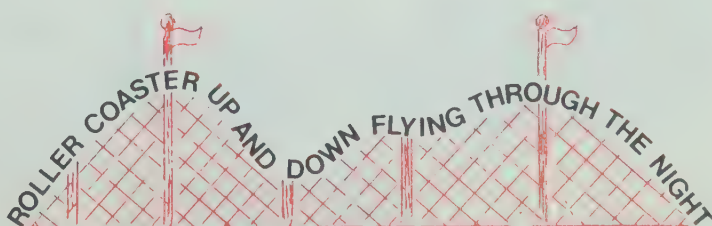
Make a list of all the fairs the children have attended. Record the number of children who attended each fair. You may be able to use this data to make a graph. Discuss which fairs many children have attended. Have them suggest reasons for the popularity of these fairs.

Activities at a Fair

Have the children list the activities at a fair. Encourage them to comment on which of these activities are their favorites. Make a bar graph to show the favorite activities of the children.

Poetry in Motion

Rides are a popular pastime for children at a fair. List the rides that the children can recall. Beside each ride, record three or four words suggested by that ride. Then ask the children to create short poems about the rides and print them in a way that indicates the ride. For example, the following poem suggests a roller coaster.



Games of Chance and Games of Skill

Children are attracted to games at a fair by the prospect of winning an exciting prize. Some games depend on luck, whereas others require a degree of skill.



Make a chart similar to the following. Then record games at a fair in the appropriate column.

Games of Chance	Games of Skill

Discuss which type of game there is usually more of at a fair and why this is the case. From the chart, choose one or more games from each column that can be set up easily in the classroom. Have the children try each game and decide whether it is easier to win by luck or by skill.

Making Comparisons

Discuss how situations or ideas can be compared. Then encourage the children to make the following comparisons.

- the fairgrounds while the fair is on and the fairgrounds after the fair is over
- the fair as seen from the ground and from the top of the ferris wheel
- the fair during the day and during the night

Interpretations

Children often can interpret the excitement of a fair through movement. Play some music that suggests the excitement of a fair or the motion of a ride. Encourage the children to move freely in the following ways.

- Move as you would through a crowd at a fair. Stop and watch a ride or a game during your walk.
- You are in charge of the booth for throwing darts. Without using your voice, show how you would get people to try their skill at your game.
- Walk along the midway. Sample something to eat at each booth. Show how you feel at the end of the walk.

Theme for Unit 12: Conservation

Because of the continuing emphasis on our relationship to the environment, it is important for children to increase both the awareness and appreciation of the world around them. Although we cannot control such things as the supply of air or the amount of sunshine, we can regulate the supply of other natural resources, such as soil, water, forests, minerals, and wildlife.

Studying the Environment

Children should understand the elements that constitute the natural environment and think about the extent to which people alter these elements. Investigate the following features of the natural environment through reading and discussion or by actually visiting a pond, swamp, or forest.

Soil

The type of soil influences the kinds of life it can support and determines geographic characteristics. Collect several types of soil. Have the children feel and describe the textures of the different types. Ask questions similar to the following.

- “Which type of soil holds water easily?”
- “What different colors do you notice?”
- “What plants will grow in each type of soil?”
- “How does weather affect the soil?”
- “In what natural ways is soil improved?”

Pond

Have the children discuss their ideas of a pond by asking questions such as:

- “How would you describe a pond?”
- “Where does the water for a pond come from?”
- “What plants are found in a pond?”
- “What plants are found around a pond?”
- “What animals live in a pond?”
- “What animals live near a pond?”
- “How do the seasons affect a pond?”
- “How do the seasons affect the plant and animal life of a pond?”

Swamp

Have the children discuss their ideas of a swamp by asking questions such as:

- “What smells are found in a swamp?”
- “What plants are found in a swamp?”
- “What animals live in a swamp?”
- “How does a swamp offer protection to some birds and animals?”
- “Why are swamps necessary to the environment?”
- “How does the water in a swamp differ from the water in a pond?”

Forest

Have the children tell what they know about a forest. Direct the discussion with questions similar to these.

- “How do forests vary in size?”
- “How do the seasons change the appearance of the forest?”
- “How does nature improve a forest?”
- “What sounds are heard in a forest?”
- “What animals live in a forest?”
- “How do the plants in forests vary?”
- “What happens to wildlife when forests are cut down?”

Fields and Meadows

Have the children tell what they know about fields and meadows. Ask questions such as:

- “What colors do you notice in fields and meadows?”
- “What birds are found in fields and meadows?”
- “What animals are found in fields and meadows?”
- “How do insects make their homes here?”
- “What is the main type of vegetation?”
- “Do meadows easily support wildlife?”

Controlling the Environment

After looking at some of the natural elements of the environment, explore some of the controls that people impose on these. Encourage the children to comment on the results of the following controls.

Stocking Ponds and Rivers

Stocking is necessary for a variety of reasons. Sometimes natural causes such as disease or drought deplete the fish stock in a body of water. Sometimes people pollute the water and kill the fish with waste materials. Lead a discussion by asking these questions.

- “What kinds of fish are used in stocking?”
- “What sizes of fish are used in stocking?”
- “What effect does stocking have on a river or a pond?”

Damming Rivers

To prevent damage to people, buildings, or nature, dams have been built to control high water. Often a reservoir created by a dam offers opportunities for swimming and boating. Children may wish to tell of being involved in such opportunities.

People have learned to create electricity for homes and industries from water power. Dams are built to create force for running the generators and turbines that produce electric power. Ask what natural ways there are for supplying this force.

Reforestation

In order to maintain a constant supply of trees for lumber and for pulp and paper, trees are planted regularly and the cutting of trees is controlled. Trees are planted on hillsides to prevent water from running off quickly and washing away the soil. Trees are also planted along the edges of fields to check the force of the wind and help prevent soil erosion.

Mineral Conservation

Although new trees can be planted to take the place of those that have been cut down, once minerals have been removed from the earth, the supply cannot be renewed. Discuss how minerals can be conserved by reusing them or finding substitutes for those that are scarce.

Protective Laws

When an environment is destroyed, it cannot be replaced easily. To help prevent damage to our environment there are special laws in effect, such as those relating to campfires. Discuss other laws that protect the environment.

Hunting and Fishing

Limits are placed on the seasons and the length of time for hunting and fishing. Some animals and fish may not be hunted or caught in certain areas. Limits are also placed on the number of various species that may be taken. Discuss why it is sometimes necessary to keep animals from becoming too plentiful. Some people believe that hunting should not be allowed at all. Encourage the children to express their opinions.

Preventing Pollution

Since some containers do not deteriorate, they clutter natural areas for many years. Some man-made materials actually poison wildlife. Containers that can be reused help to reduce the disposal problem. Placing garbage in proper containers also keeps the environment clean.

Because many towns and cities get their water from lakes and rivers, laws have been passed to prevent industries from dumping wastes into the rivers and streams. These wastes often endanger the supply of drinking water. Discuss why these laws are not always effective.

Wilderness Areas

Some areas have been set aside as wilderness or natural areas. The cutting of trees and hunting of animals are not allowed in these areas. Discuss why wilderness areas are desirable.

Enjoying the Environment

Although it is necessary to protect our natural environment, we can still use and enjoy it. Have the children list activities that provide the opportunity to use and appreciate the natural surroundings. The list may include the following.

- camping
- canoeing
- sailing
- swimming
- hiking
- skiing

Discuss the benefits of each of these activities. Ask in what ways we care for the environment while engaging in these activities.



Pages T 349 to T 370 include materials that have been referred to in the teaching suggestions for various lessons. Although suggestions for using many of these materials are given in the related lesson outlines, other suggestions for some of the materials are given below.

The chart on page T 353 may be used not only for showing the current month, but also for making weather charts for various months, birthday months of individual children, and records of different activities and events such as class trips.

The shapes on pages T 355 and T 356 may be used for making attribute blocks (see page xxiv) since the actual size is shown. These shapes also lend themselves for work with fractions since their dimensions are such that four of one small shape exactly cover the corresponding large shape (with the exception of the circles). The large circle is a suitable size for making individual number spinners.

The patterns for the three-dimensional shapes on pages T 357 and T 358 are marked with recommended dimensions. You may find it easier to construct these shapes if each pattern is outlined first on squared paper (page T 365), using the centimetre grid lines as a guide.

Because the number lines on page T 359 are marked into centimetres and half centimetres, copies of several of these may be pasted together to make "metre tapes" for the children to use in their measuring activities. The sixth number line on page T 359 is marked into millimetres. Copies of this number line placed vertically will provide scales for showing temperatures.

Copies of the 10-by-10 grid on page T 360 may be used for preparing individual game boards or work sheets for activities. The 11-by-11 grid may be used for preparing tables of basic addition or multiplication facts.

Copies of page T 361 will be suitable for preparing models of hundreds, tens, and ones for the children. These may be prepared by pasting the cutouts on cardboard, laminating the surface (optional), and then cutting the models apart as desired.

To make models for thousands, ten single models of hundreds may be stapled or taped together to represent one thousand.

Copies of page T 365 may be used for activities involving slides, flips, and turns; line symmetry; bar graphs and line graphs.

Copies of page T 366 may be used in many different ways. Some suggestions are as follows: for activities similar to those in Ex. 9 to 14 on page 77; for reinforcement for pages 100 to 103 (any two dots are joined to form a line segment for which the children estimate and then measure its length); for reinforcement for pages 104 and 105 (dots are joined to form a simple shape and then the children find the perimeter of the shape); for reinforcement for pages 182 and 183 (dots are joined to form a simple shape which the children color and then find its area); for providing arrays for which the children write the multiplication or division sentences; for children to show the size of arrays for given multiplication and division sentences.

If you wish to demonstrate tangram pictures using an overhead projector, copy the tangrams on page T 368 onto a sheet of colored acetate, cut the pieces apart, and then reassemble them on the overhead projector to show tangram pictures.

Peg Abacus

A simple peg abacus can be made from a Styrofoam tray, three wires of equal length cut from coat hangers, and plaster of Paris. Fill the tray with a mixture of plaster of Paris. Before it sets, insert the three wires and then allow the plaster to set. Use objects (colored wooden beads, washers, or empty spools) for representing numbers. The wires should be about 5 cm long unless empty spools are to be used, in which case they should be about 30 cm long.

A sturdier peg abacus may be made using wooden dowels on a wooden base. It is important that children view the abacus from the same side and not from opposite sides, which would result in a reversal of the place values.

To show numerals with up to six digits, place one abacus to the left of another.

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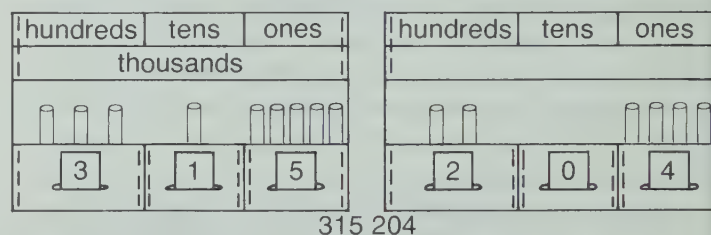


Place-value Pocket Chart

Pocket charts for demonstrating place value may be made in a variety of ways. One of the simplest forms is illustrated below.

Bristol board or thick plastic is cut in one piece, folded, and stitched or stapled where indicated to make three pockets for working with hundreds, tens, and ones. Slits may be made in the pockets to accommodate numeral cards for showing the standard numeral for the number of hundreds, tens, and ones displayed.

This chart may be fastened to the display board or other convenient location. For showing numerals with up to six places, one pocket chart may be placed beside another.



Elevator Beads

This is a convenient device for children to use for counting and for illustrating number facts, because the beads may be pushed along the string to stay in certain positions.



Select 25 beads of one color and 25 of another color. Cut a piece of string more than twice the length of the 50 beads, being certain to provide plenty of slack. Fold the string in half and at the folded end tie a knot for a finger loop. Thread the two ends of the string through each bead with each of the two strands going through the hole from opposite sides. Continue to place the beads on the string, alternating the colors, until the 50 beads have been used. Tie a knot in the string, leaving some slack at the end.

Games

Concentration

Materials: pairs of matching cards

Players: one to four

Rules:

- Shuffle the cards. Then place them face down on a table.
- A player selects two cards and shows them to the other players. If the two cards match, the player claims the cards and continues her/his turn until the two cards do not match. The two cards that do not match are returned face down as the other players watch. It is then the next player's turn.
- When all the cards have been claimed, the player with the most cards is the winner.

Dominoes

Materials: 30 domino cards

(When preparing the domino cards, place the cards in a row and make each card match at either end of the row. This ensures that the cards can be matched in the game.)

Players: one to four

Rules:

- Give five domino cards to each player. Place one of the remaining domino cards face up and the others in a pile face down.
- If a player has a domino card that matches either end of the first card, or later in the game matches either end of the row, he/she places the card to continue the row. It is then the next player's turn.
- If the player does not have a domino card that matches either end of the row, he/she draws a card from the pile. It is then the next player's turn.
- The first player without any cards is the winner.

Give Me a Clue

Materials: 19 cards, one naming each day of the week and one naming each month of the year

Players: three to five

Rules:

- The cards are shuffled and placed face down in a pile.
- One player draws the top card and gives a few clues for the name on the card. Clues for July could be, "We have holidays. The weather is usually hot. It is the month of Canada's birthday." Clues for Tuesday could be, "We go to school. We have gym."
- Each of the other players has one chance to guess the name of the day or the month. The first player to guess correctly claims the card. If no player guesses the name, the card is placed at the bottom of the pile.
- The game ends when all the names have been identified.
- The player with the most cards is the winner.

Snap

Materials: pairs of matching cards

Players: two to four

Rules:

- Shuffle the cards and deal them as equally as possible among the players.
- The players turn up the top card of their piles at the same time. If two of the cards match, the player who calls "Snap" first wins the matching cards. If the cards do not match, play continues with the players turning up cards at the same time.
- The player with the most cards at the end of a given time is the winner.

Match Up

Materials: 12 sets of cards that match (A set consists of two or three cards, depending on the concept being reinforced.)

Players: two or three

Rules:

- Shuffle all the cards. Deal six cards to each player. Place the remaining cards face down in the center of the table as a drawing pile.
- Each player in turn takes a card from the drawing pile. If he/she has a set of cards that match, he/she shows them to the other players, places them face down in a separate pile and discards a card from his/her hand. If he/she does not have a set of matching cards, one card is discarded and the next player has a turn.
- When the last card is taken from the drawing pile, the discard pile is shuffled and becomes the drawing pile.
- The winner is the first player without any cards.

Total Action

Materials: 46 cards as described for each version of the game

Players: two to five

Rules:

- Shuffle the cards. Deal six cards to each player. Place one card face up as a discard pile and place the remaining cards face down as a drawing pile.
- Each player in turn takes the top card from the drawing pile or from the discard pile. If the player has a set of winning cards, he/she shows them to the other players, places them face down in a separate pile, and discards a card from his/her hand. If the player does not have a set of winning cards, he/she discards a card from his/her hand and then the next player has a turn. A set of winning cards is any number of cards having the sum named for each version of the game, since the sum required depends on the concept being reinforced.
- When the last card is taken from the drawing pile, the discard pile except for the top card is shuffled and becomes the drawing pile.
- The winner is the first player without any cards.

Product Search

Materials: a die marked 0, 1, 2, 3, 4, 5;
a die marked 4, 5, 6, 7, 8, 9;
a different color crayon for each player;
a game board as shown.
(Copies of page T 360 may be used.)

×	0	1	2	3	4	5
4						
5						
6						
7						
8						
9						

Players: two to four

Rules:

- Each player in turn throws the dice and states the product for the factors shown.
If the product is incorrect, the next player has a turn.
If the product is correct, the player locates a square for the product on the game board and colors it. When a square has been colored, it cannot be used again. A player may color only one square for each turn. If no square is available, the next player has a turn.
- The player who colors the most squares after an agreed number of rounds is the winner.

Check Off

Materials: a three-by-three grid for each player;
at least six markers for each player;
a pencil for each player;
a list of sixteen numbers determined by the concept being reinforced.

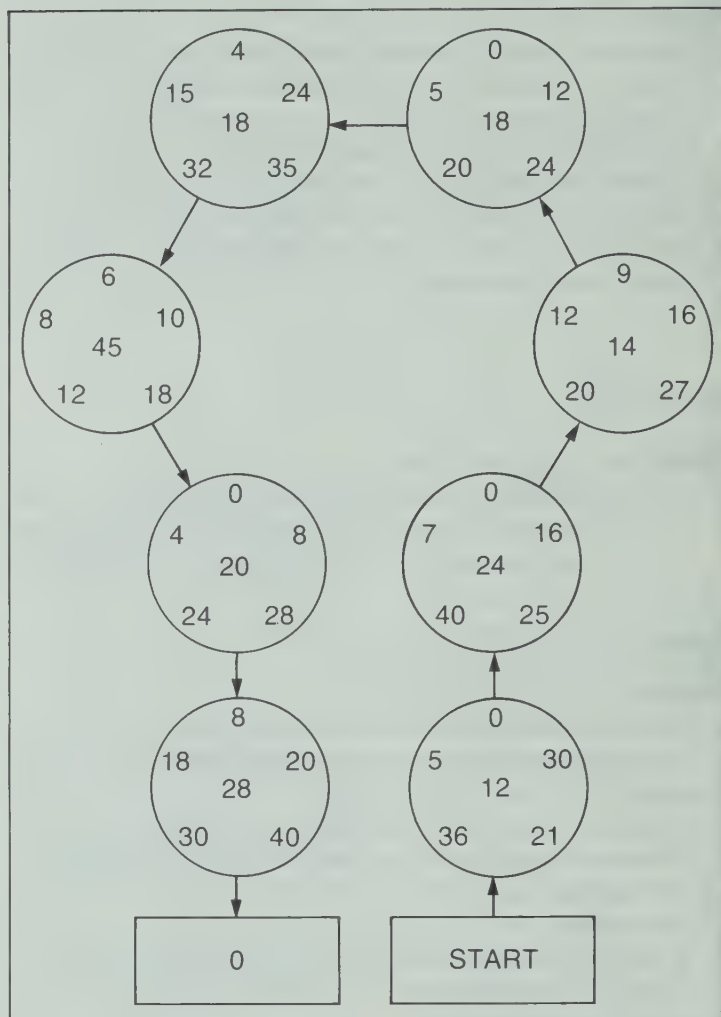
Players: any number

Rules:

- As the caller reads the list of numbers, each player records any nine of them on her/his grid, writing one in each square.
- The caller states each number on the list in random order and in a different way. (The way is determined by the concept being reinforced by the game.) As the caller states a number he/she places a check beside it on the list. Players who have the number called either mark it with their pencils or cover it with a marker on their grids.
- The first player to cover three squares horizontally, vertically, or diagonally and have them verified as checked on the caller's list is the winner.

Find Our Product

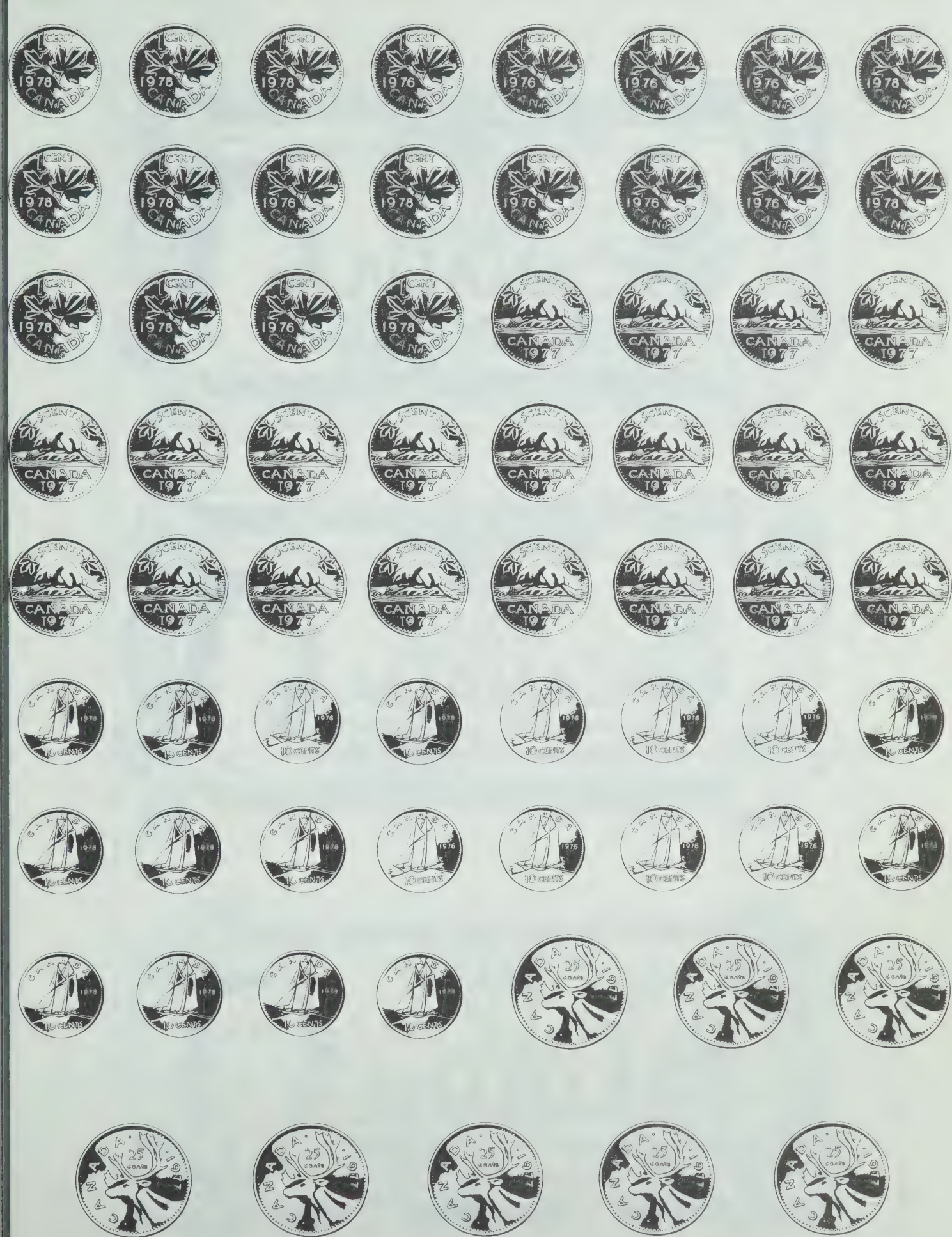
Materials: a game board similar to the one shown;
a marker for each player;
one die marked 0, 1, 2, 3, 4, 5;
one die marked 4, 5, 6, 7, 8, 9.



Players: two to four

Rules:

- The players take turns throwing the dice and finding the product of the numbers shown on the two dice.
- Each player starts with her/his marker in the "Start" box, and advances to the first circle only if the product obtained is found there. Advances to successive circles follow the same rule. Otherwise, the marker must stay where it is until the player's next turn.
- In order to leave the last circle, a player must obtain a product of 0.
- The player who first leaves the last circle is the winner.





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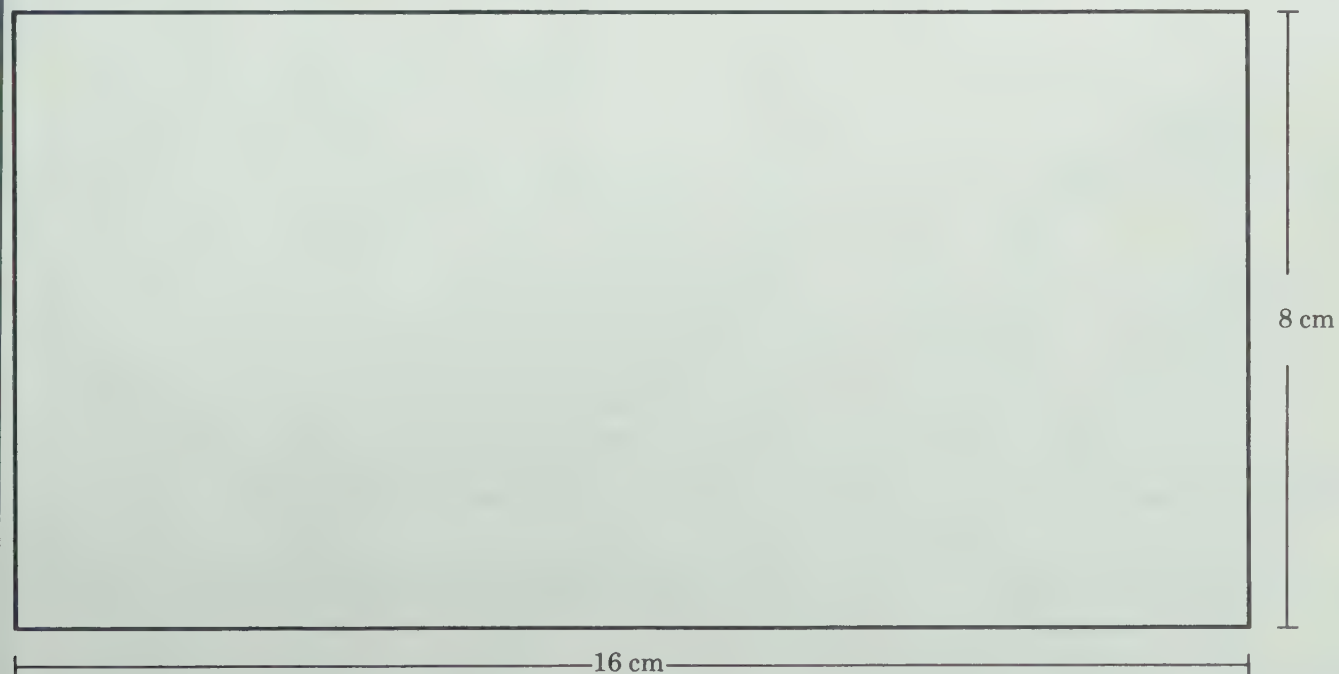
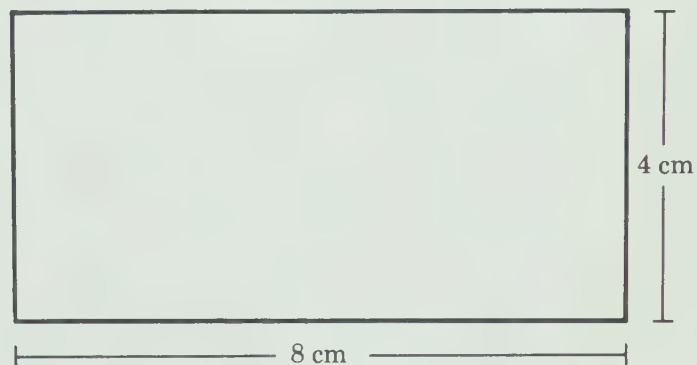
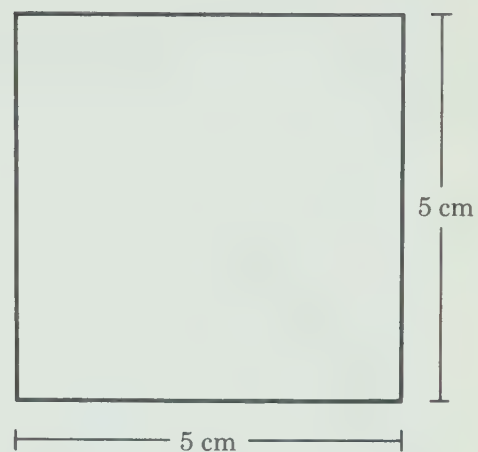
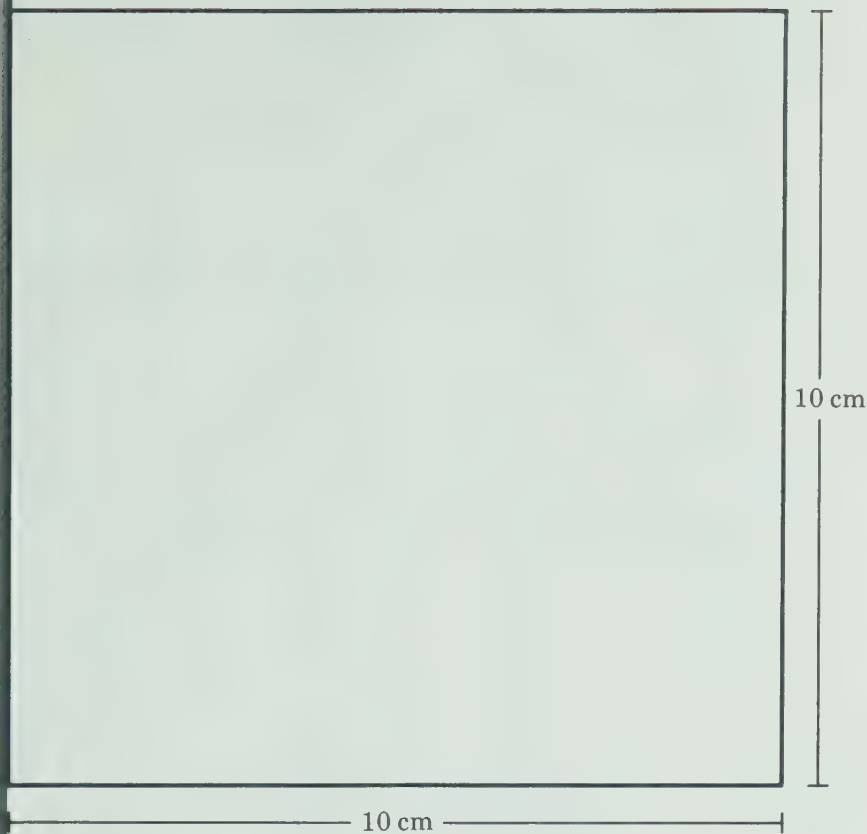


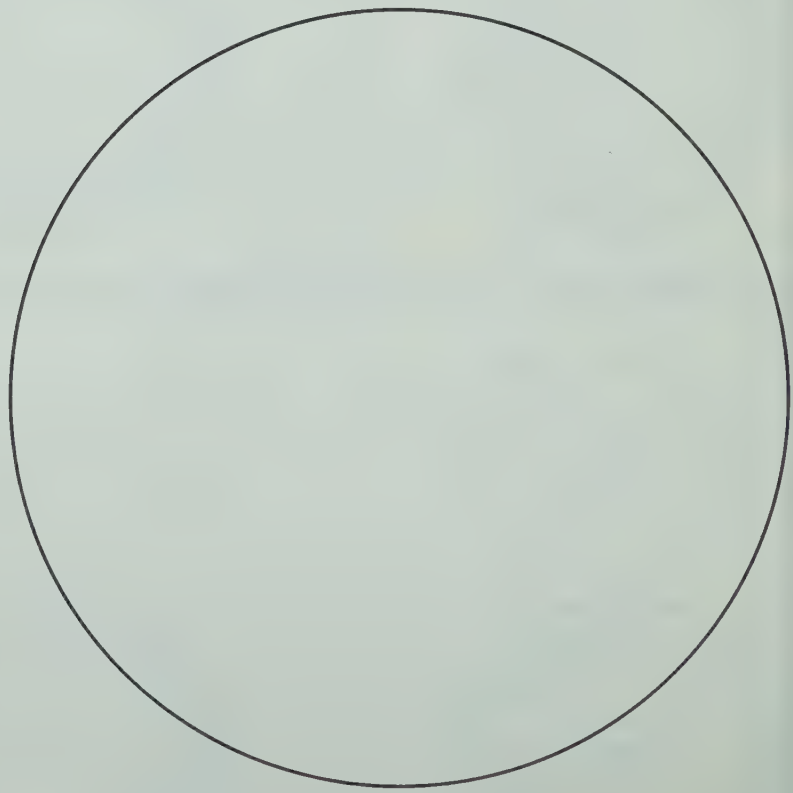
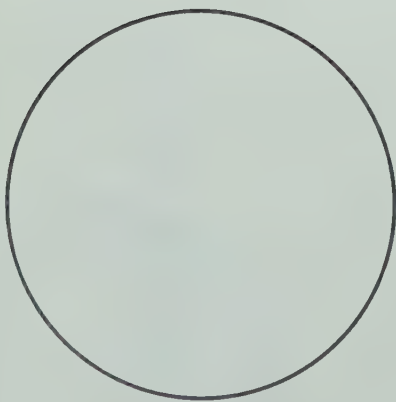
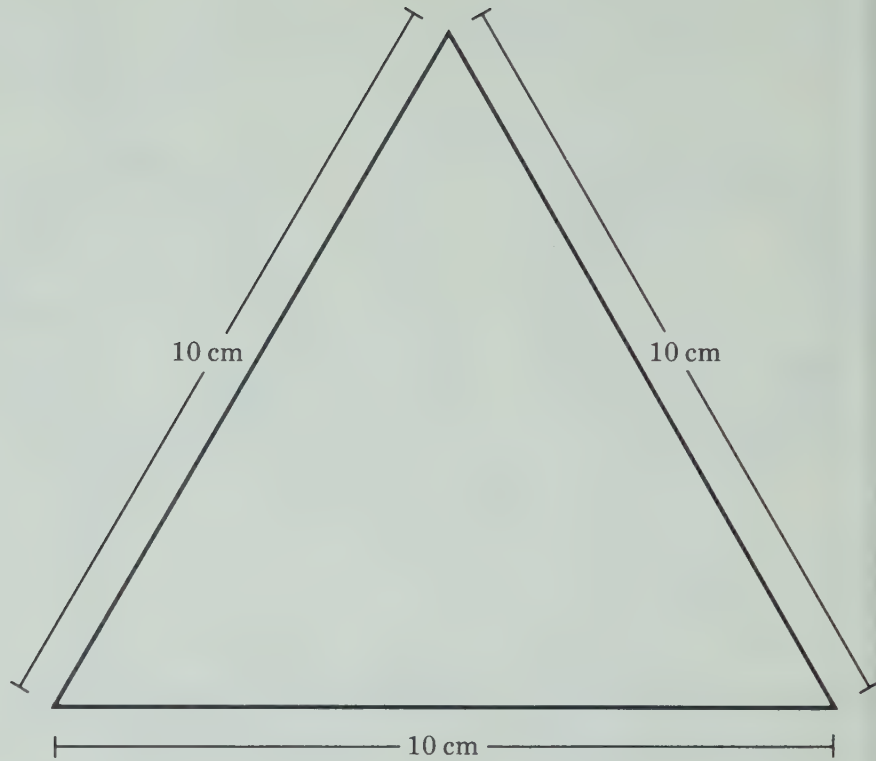
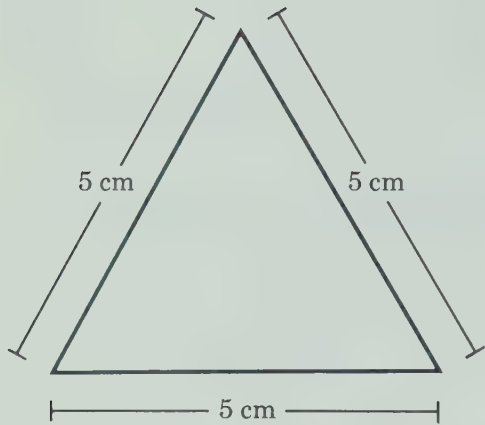
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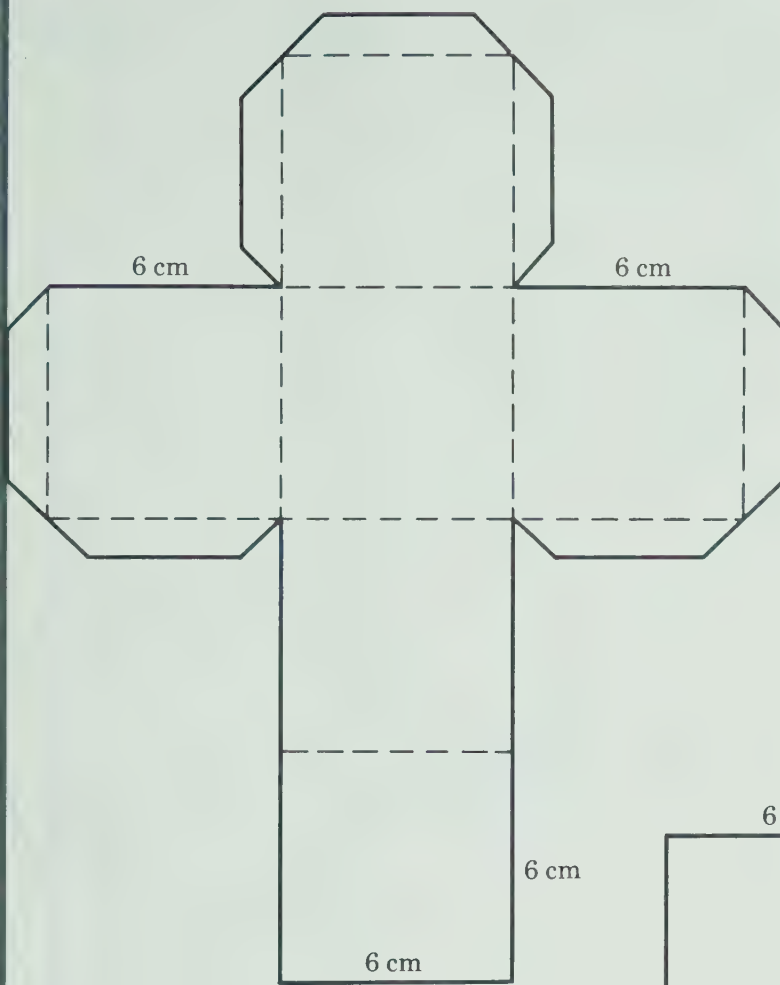
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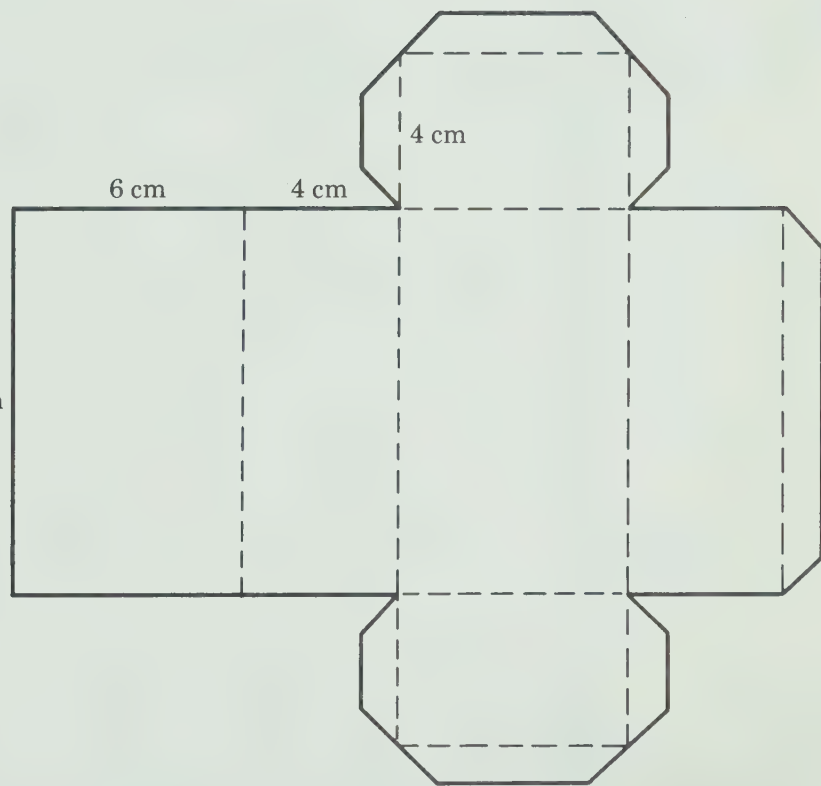




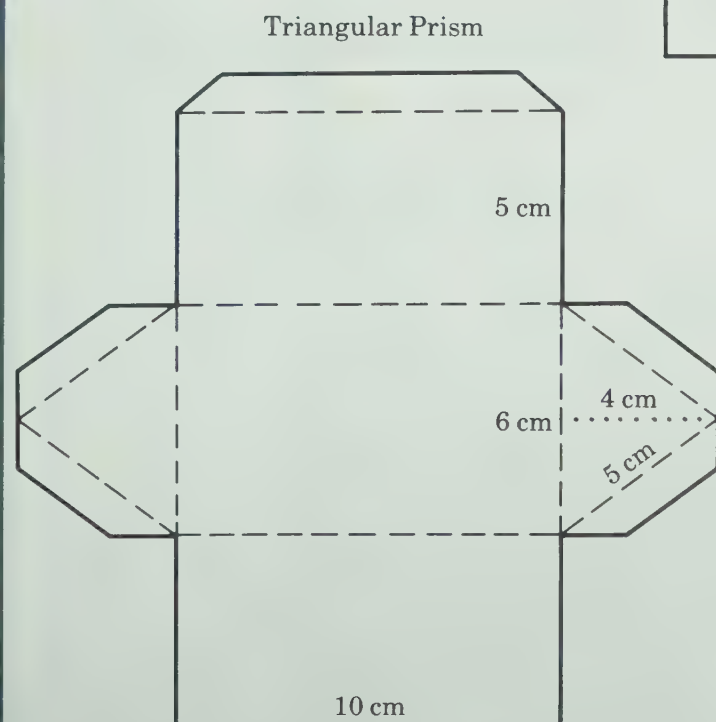




Cube

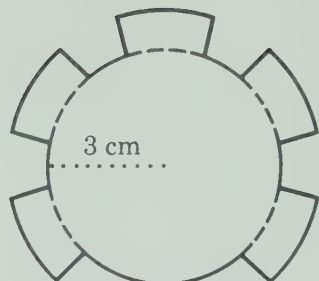


Rectangular Prism



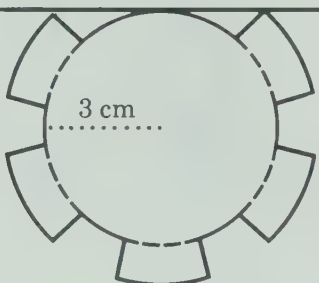
Triangular Prism

Cylinder



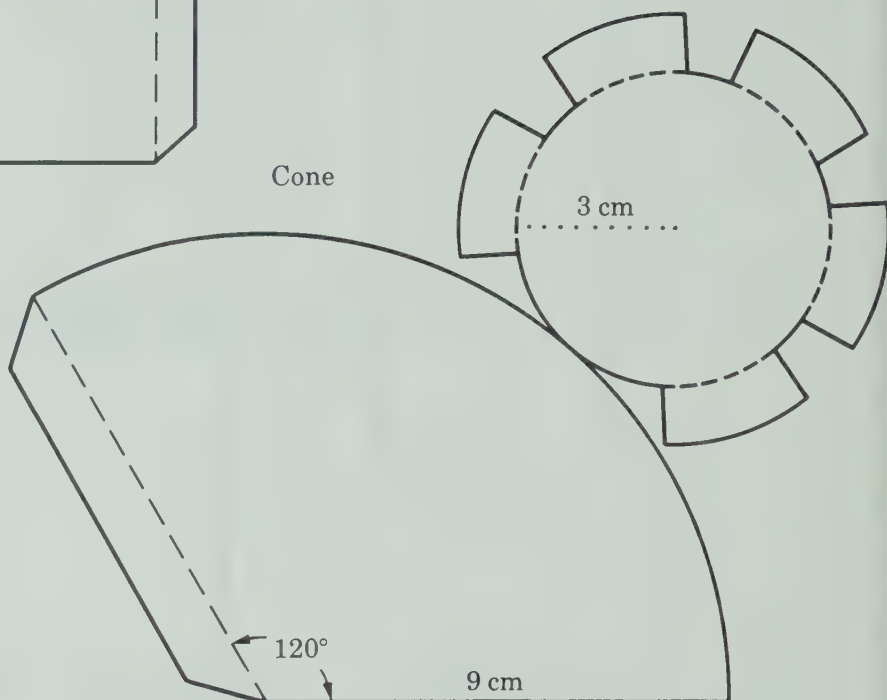
19 cm

10 cm



3 cm

Cone

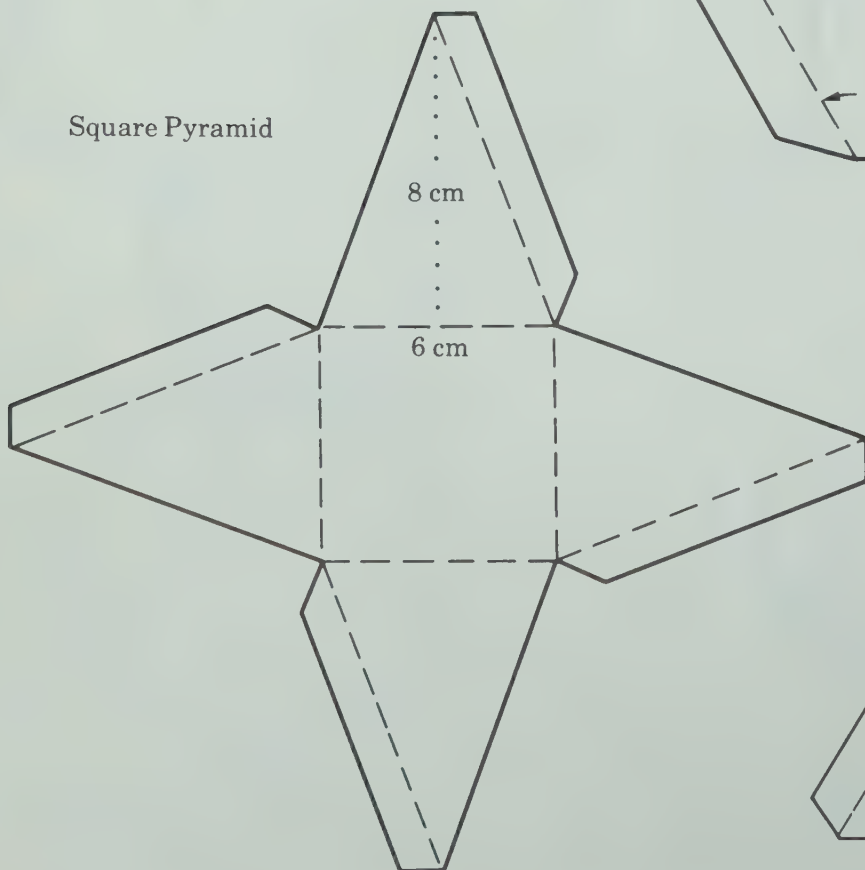


3 cm

120°

9 cm

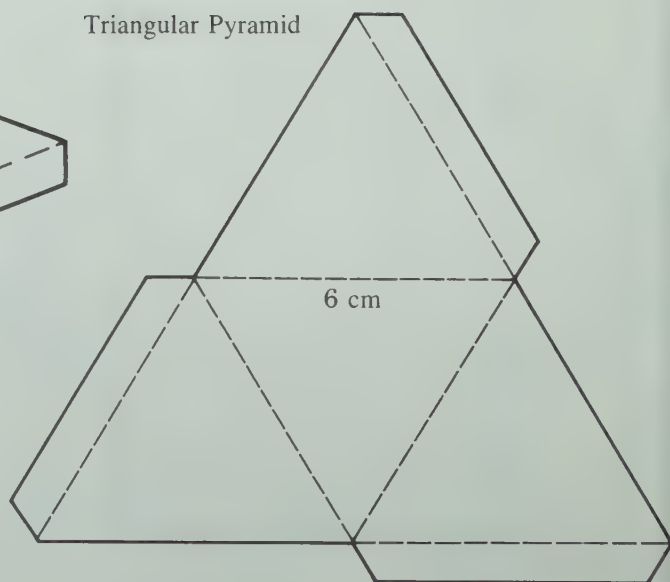
Square Pyramid



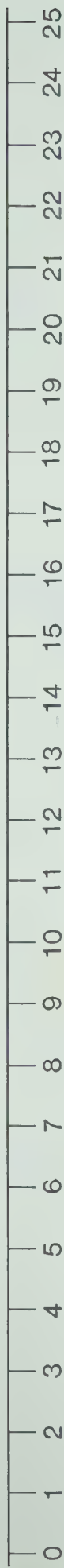
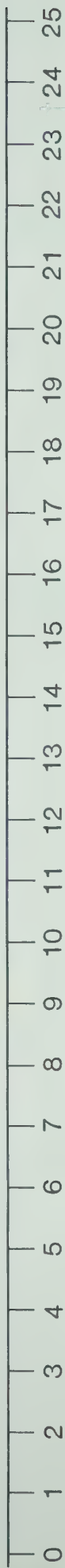
8 cm

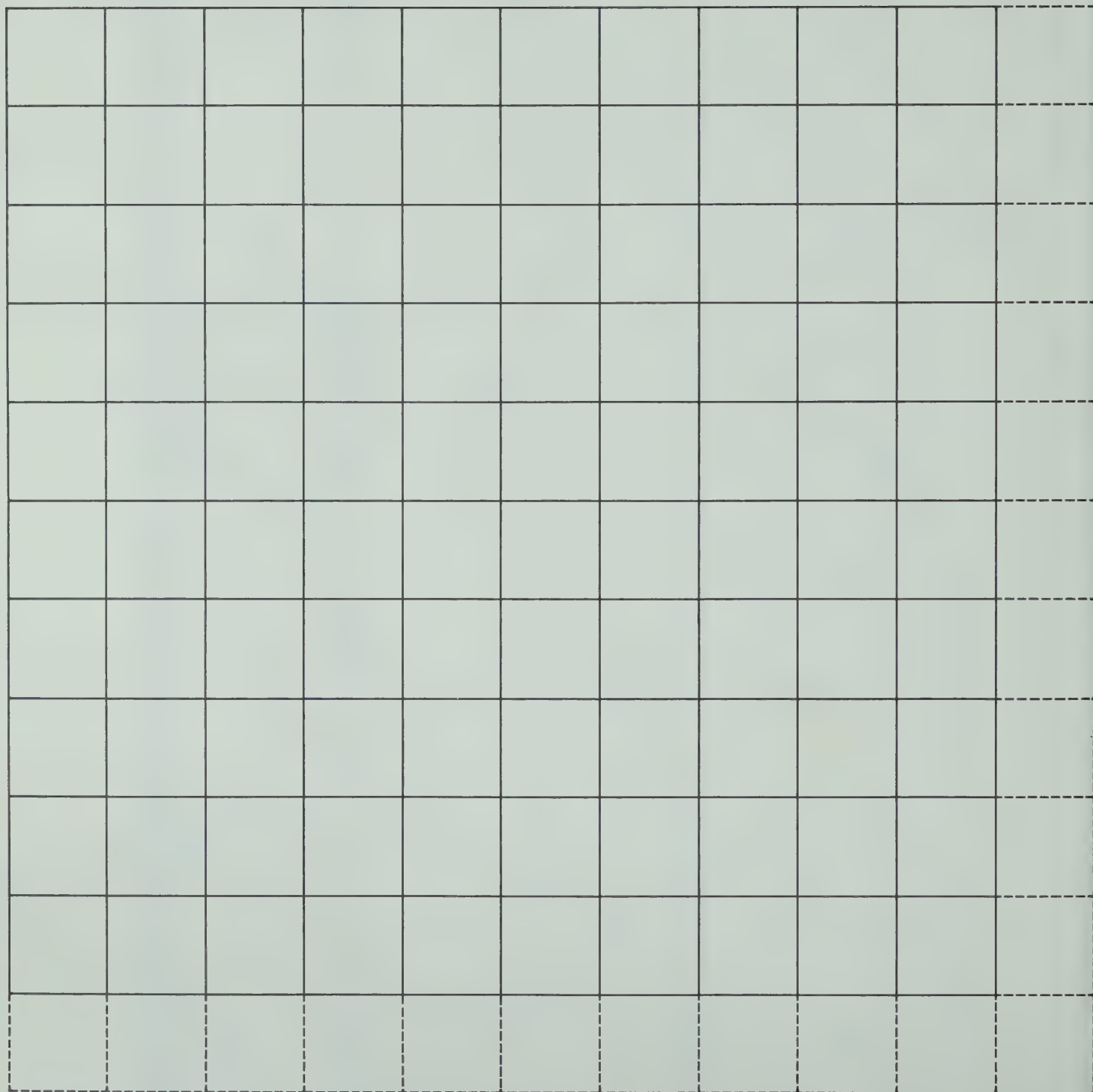
6 cm

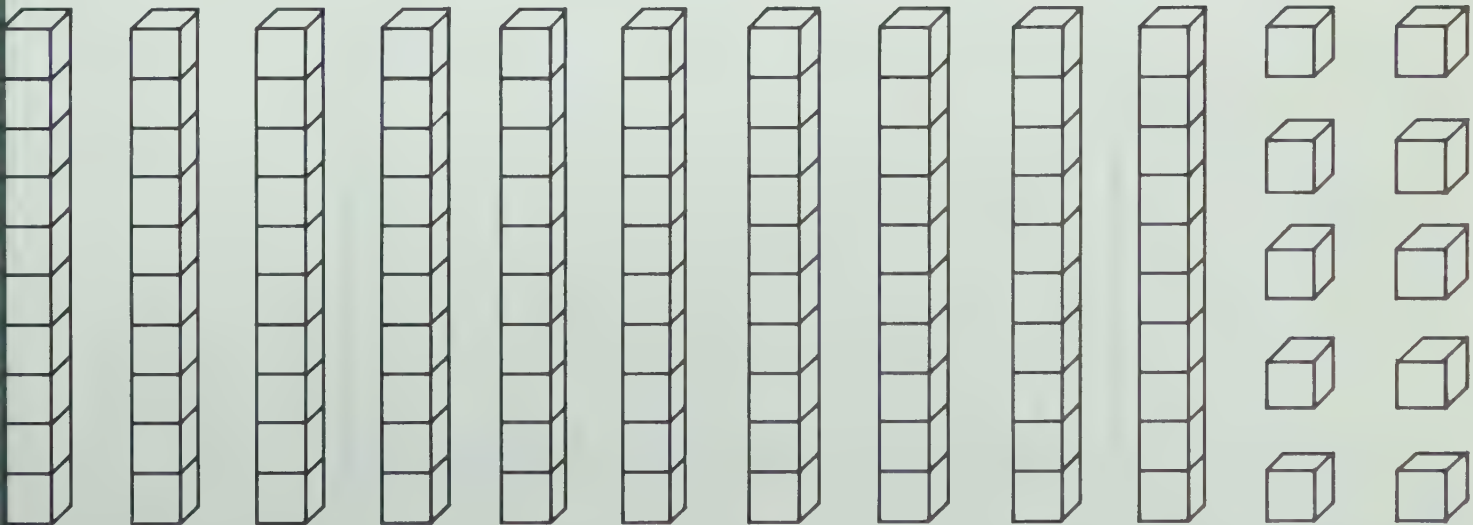
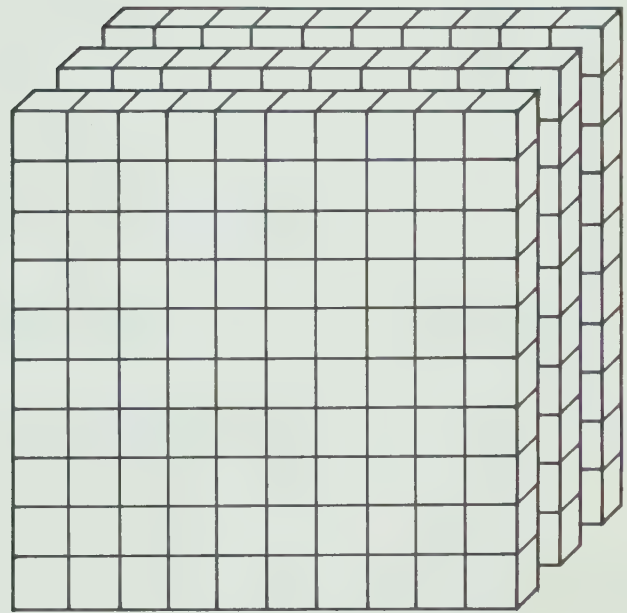
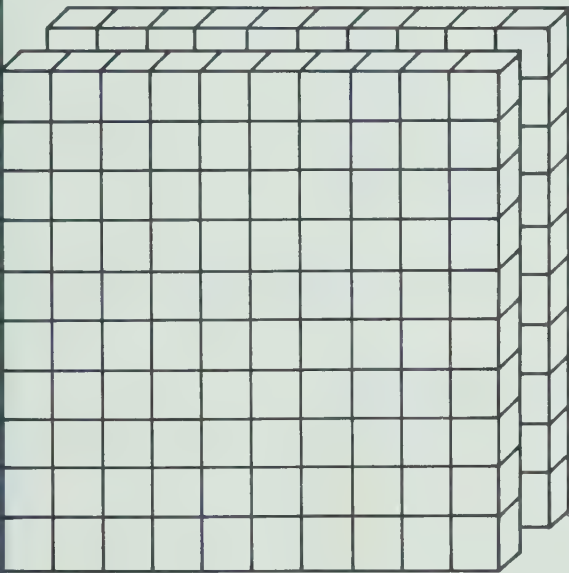
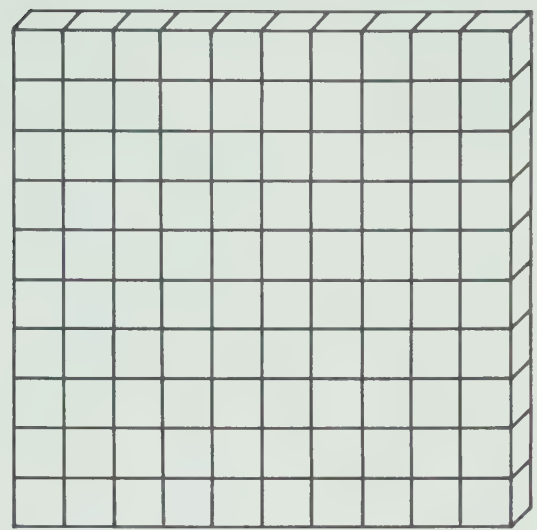
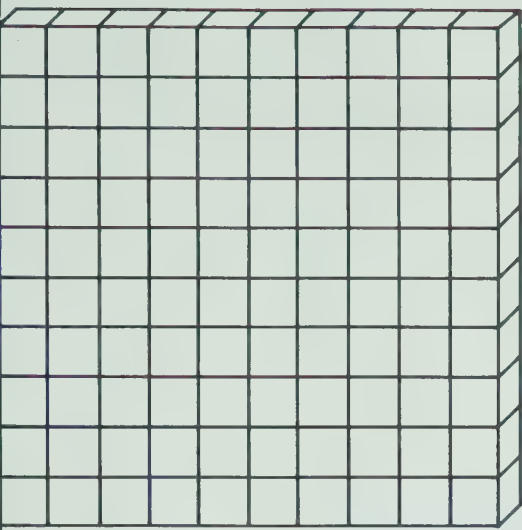
Triangular Pyramid

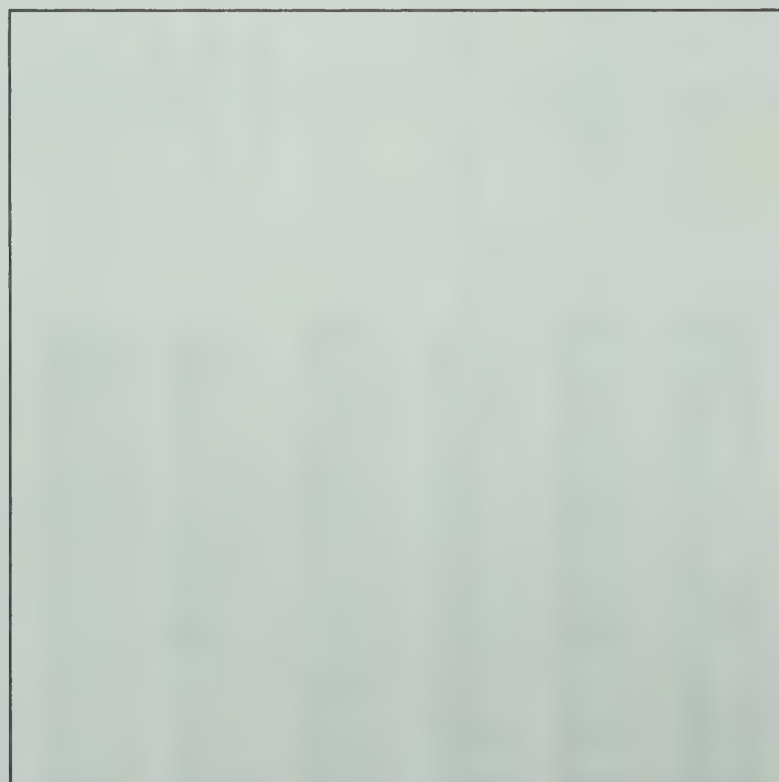
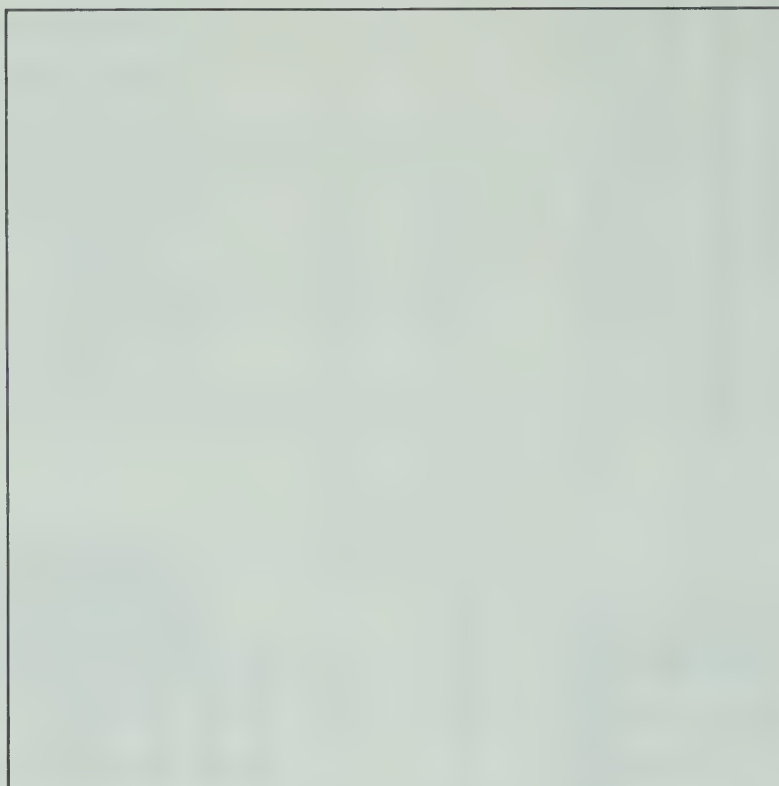


6 cm



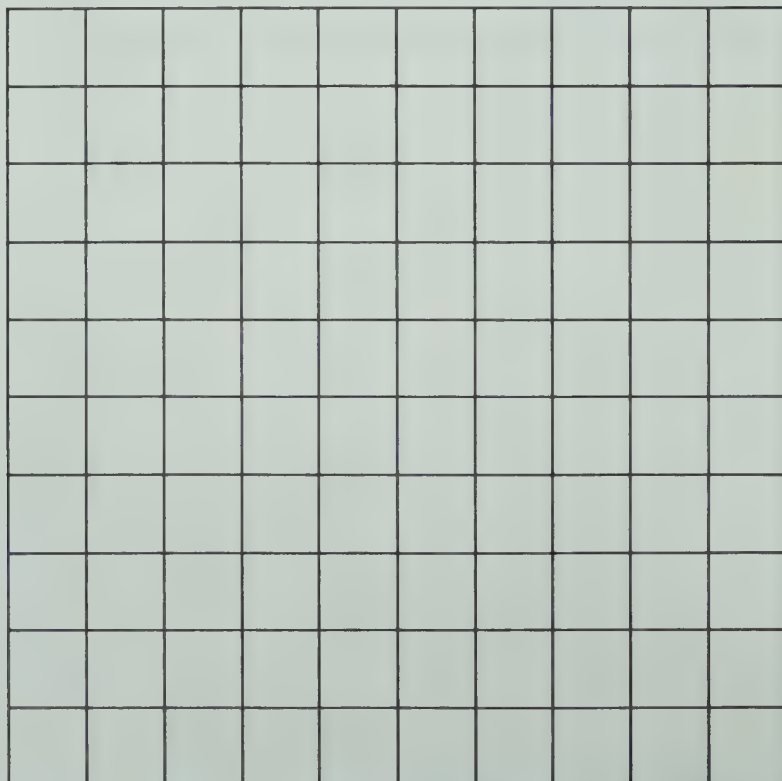
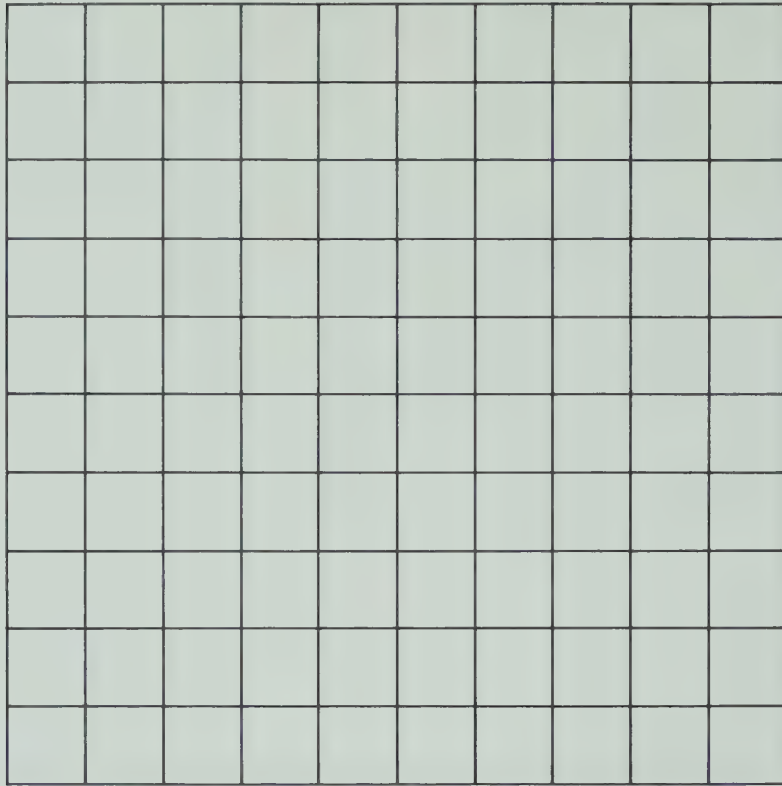


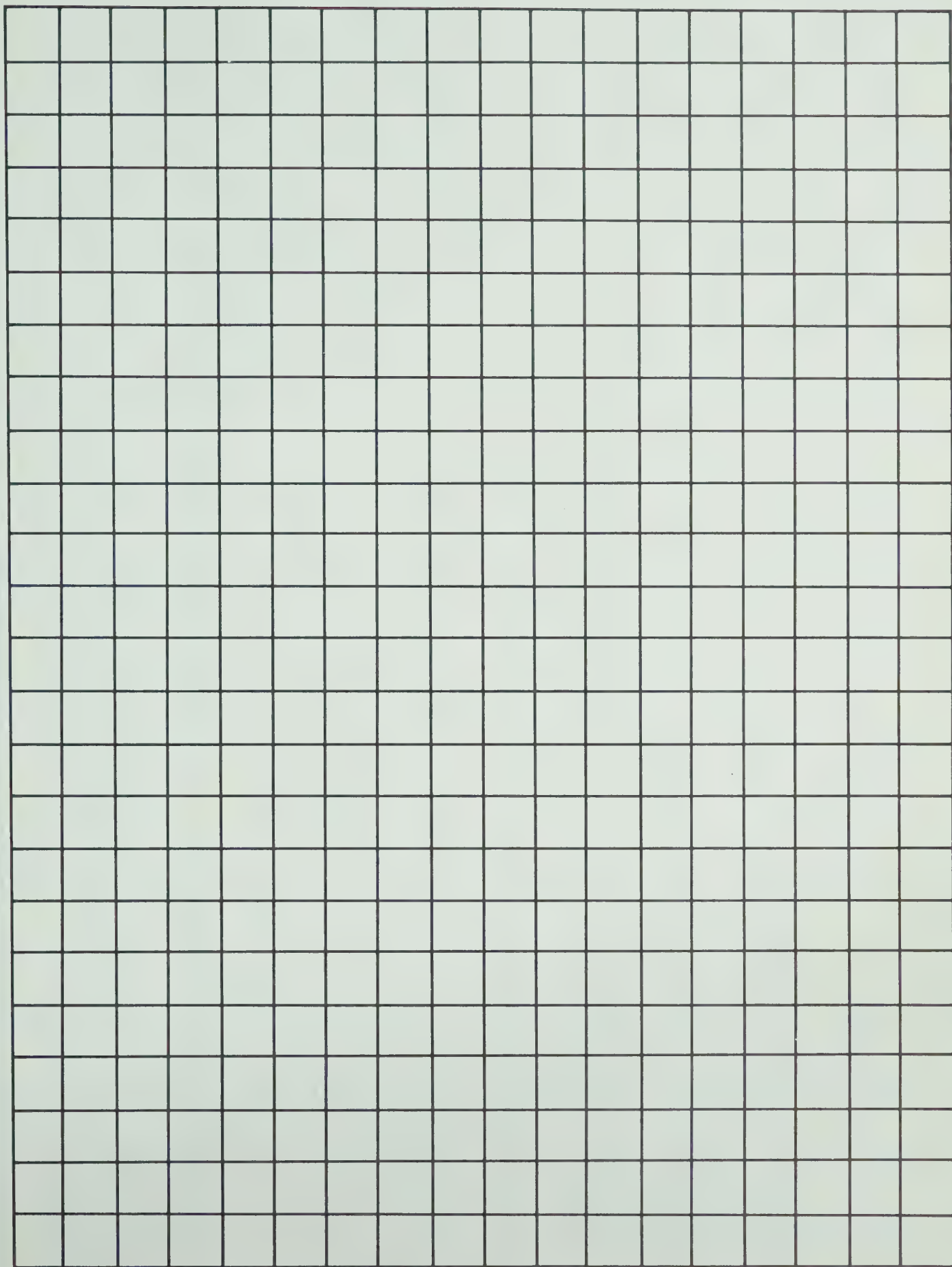


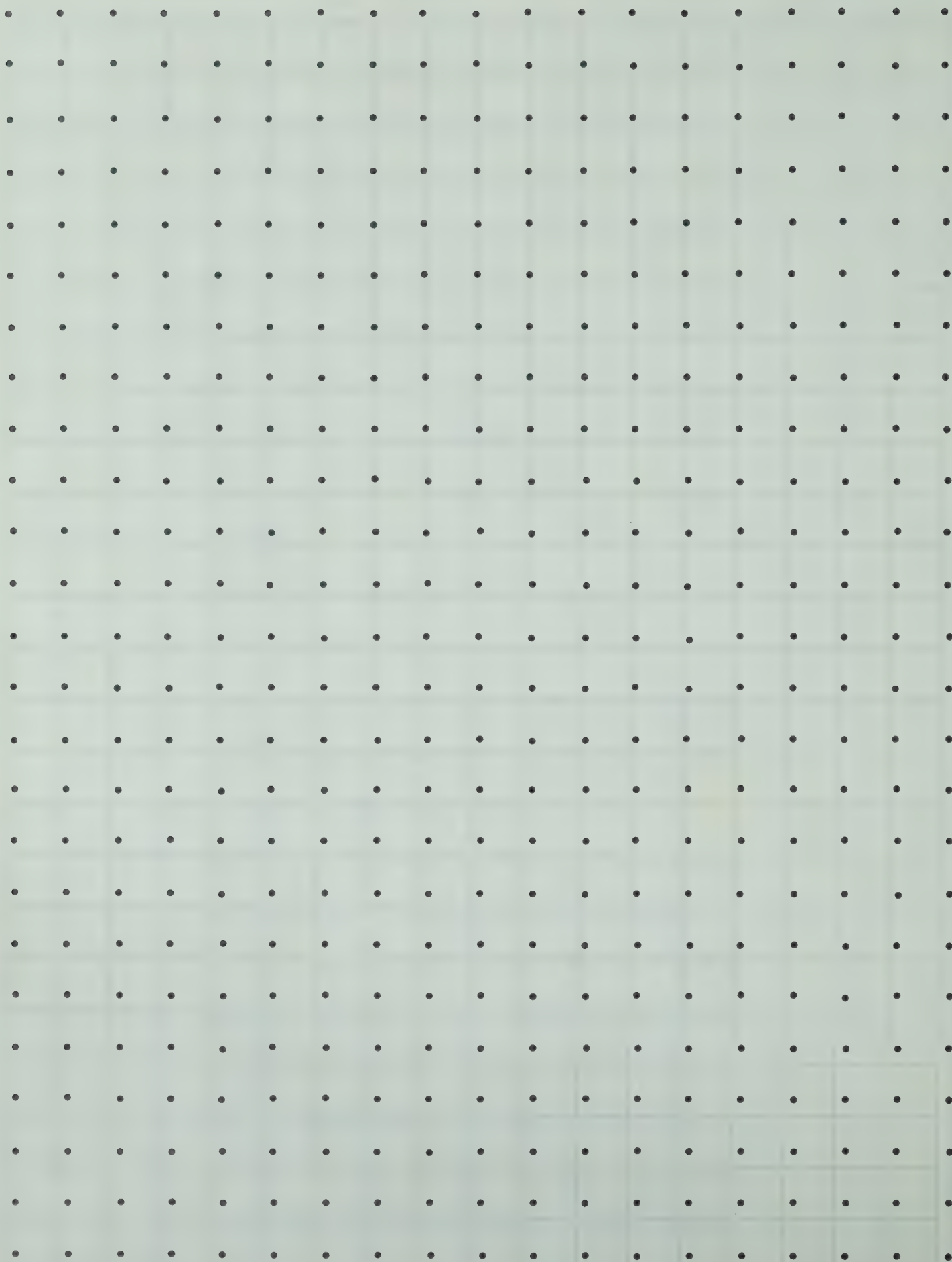


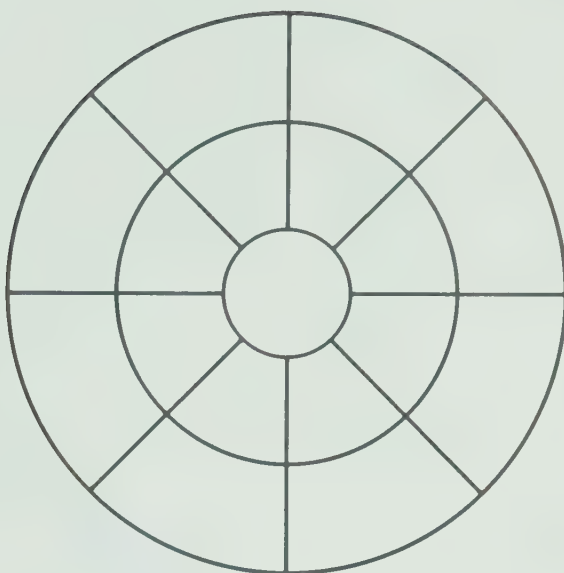
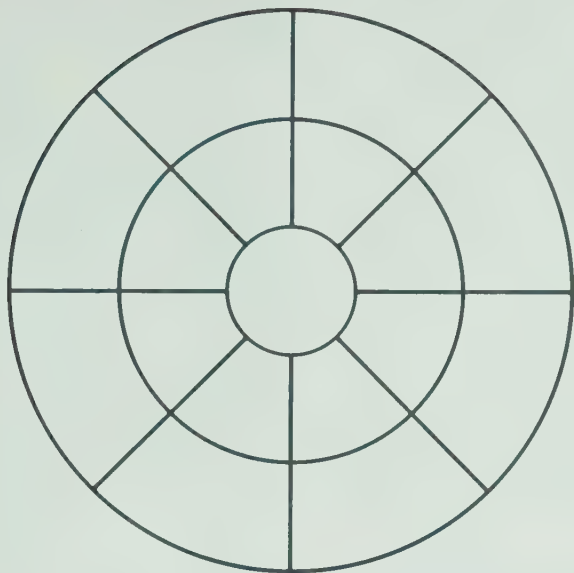
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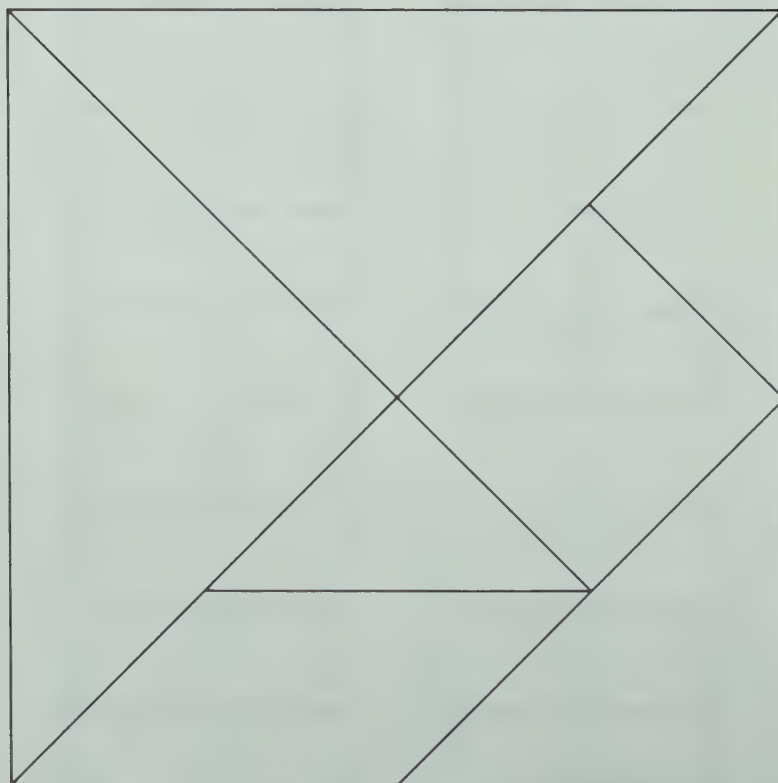
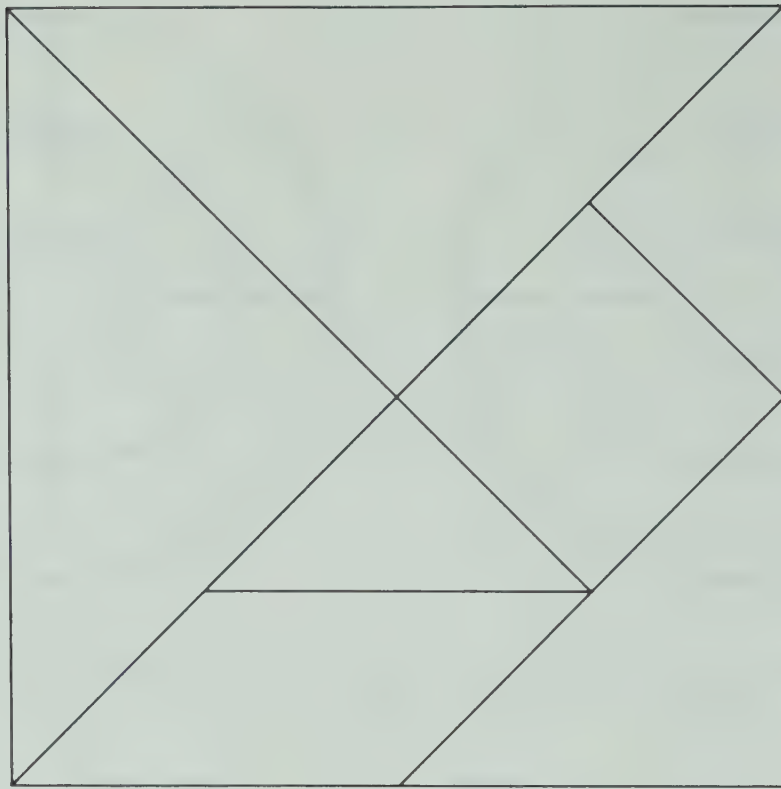



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Numeration

1. Reads standard numerals to 9999 ☐
2. Writes standard numerals to 9999 ☐
3. Interprets place value in numerals to 9999 ☐
4. Understands sequence of numbers to 9999 ☐
5. Orders/Compares numbers to 9999 ☐
6. Reads/Writes words for numbers to 9999 ☐
7. Understands/Writes expanded form for numbers to 9999 ☐
8. Uses ordinal number concepts to *thirty-first* ☐
9. Renames ones as tens and tens as ones ☐
10. Renames tens as hundreds and hundreds as tens ☐
11. Renames hundreds as thousands and thousands as hundreds ☐
12. Counts by
 - a. ones ☐
 - b. twos ☐
 - c. fives ☐
 - d. tens ☐
13. Continues number sequences ☐
14. Knows meaning and use of the symbol:
 - a. \emptyset ☐
 - b. \$ ☐
 - c. = ☐
 - d. > ☐
 - e. < ☐
 - f. + ☐
 - g. - ☐
 - h. \times ☐
 - i. \div , $\sqrt{\quad}$ ☐
15. Understands/Uses the term:
 - a. greater than ☐
 - b. less than ☐
 - c. equals ☐
 - d. after ☐
 - e. before ☐
 - f. between ☐
16. Understands Roman numerals to X ☐
17. Reads/Writes words and numerals:
 - a. halves, proper and mixed form for parts of wholes ☐
 - b. halves of a set ☐
 - c. thirds, proper and mixed form for parts of wholes ☐
 - d. thirds of a set ☐
 - e. fourths, proper and mixed form for parts of wholes ☐
 - f. fourths of a set ☐
 - g. tenths, proper and mixed form for parts of wholes ☐
 - h. tenths of a set ☐
18. Reads/Writes decimals to 9.99 ☐
19. Orders/Compares decimals to 9.9 ☐
20. Matches decimals with points on a number line ☐
21. Regroups tenths as ones and ones as tenths ☐

Operations

Addition

1. Understands/Uses the term:
 - a. add ☐
 - b. plus ☐
 - c. addend ☐
 - d. sum ☐
2. Understands the operation ☐
3. Identifies additive situations ☐
4. Completes addition sentences ☐
5. Writes addition sentences ☐
6. Illustrates addition with models ☐
7. Completes vertical form ☐
8. Understands zero in an addend ☐
9. Adds three numbers ☐
10. Understands addition properties:
 - a. commutative (order) ☐
 - b. associative (grouping) ☐
11. Knows the basic facts for sums to 18 ☐

12. Writes families of facts ☐
13. Uses addition to check subtraction ☐
14. Uses extensions of basic facts ☐
15. Adds two-digit numbers, no regrouping ☐
16. Adds two-digit numbers, regrouping ☐
17. Adds three-digit numbers, no regrouping ☐
18. Adds three-digit numbers, regrouping ☐
19. Adds decimal tenths, no regrouping ☐
20. Adds decimal tenths, regrouping ☐
21. Adds amounts of money ☐
22. Solves one-step problems using addition ☐
23. Solves two-step problems using addition ☐

Subtraction

1. Understands/Uses the term:
 - a. subtract ☐
 - b. minus ☐
 - c. difference ☐
2. Understands the operation
 - a. take away (remainder) ☐
 - b. how many more or fewer (difference) ☐
3. Identifies subtractive situations ☐
4. Completes subtraction sentences ☐
5. Writes subtraction sentences ☐
6. Illustrates subtraction with models ☐
7. Completes vertical form ☐
8. Understands zero in the subtrahend, minuend, difference ☐
9. Relates to addition ☐
10. Knows the basic facts for minuends to 18 ☐
11. Writes families of facts ☐
12. Subtracts, uses addition to check ☐
13. Subtracts two-digit numbers, no regrouping ☐
14. Subtracts two-digit numbers, regrouping ☐
15. Subtracts three-digit numbers, no regrouping ☐
16. Subtracts three-digit numbers, regrouping ☐
17. Subtracts decimal tenths, no regrouping ☐
18. Subtracts decimal tenths, regrouping ☐
19. Subtracts amounts of money ☐
20. Solves one-step problems using subtraction ☐
21. Solves two-step problems using subtraction ☐

Multiplication

1. Understands/Uses the term:
 - a. multiply ☐
 - b. times ☐
 - c. factor ☐
 - d. product ☐
2. Understands the operation ☐
3. Relates to repeated addition ☐
4. Identifies multiplicative situations ☐
5. Completes multiplication sentences ☐
6. Writes multiplication sentences ☐
7. Illustrates multiplication with models ☐
8. Completes vertical form ☐
9. Knows the basic facts when one factor is
 - a. 0 ☐
 - b. 1 ☐
 - c. 2 ☐
 - d. 3 ☐
 - e. 4 ☐
 - f. 5 ☐
 - g. 6 ☐
 - h. 7 ☐
 - i. 8 ☐
 - j. 9 ☐
10. Finds products from a number line ☐
11. Uses multiplication to find the size of an array ☐
12. Understands commutative property ☐
13. Multiplies 10 and multiples of 10 by one-digit numbers ☐
14. Multiplies two-digit number by one-digit number, no regrouping ☐

15. Multiplies two-digit number by one-digit number, regrouping ☐
16. Uses the standard form (algorithm) ☐
17. Solves one-step problems using multiplication ☐

Division

1. Understands/Uses the term:
 - a. divide ☐
 - b. quotient ☐
 - c. divisor ☐
 - d. remainder ☐
2. Understands the operation
 - a. the number in each group ☐
 - b. the number of equal groups ☐
3. Associates division with sharing and grouping situations ☐
4. Completes division sentences ☐
5. Writes division sentences ☐
6. Illustrates division with models ☐
7. Uses subtraction to find a quotient ☐
8. Uses multiplication to find a quotient ☐
9. Relates division to multiplication ☐
10. Writes families of facts ☐
11. Knows the basic division facts for divisors of

a. 1 <input type="checkbox"/>	b. 2 <input type="checkbox"/>	c. 3 <input type="checkbox"/>
d. 4 <input type="checkbox"/>	e. 5 <input type="checkbox"/>	f. 6 <input type="checkbox"/>
g. 7 <input type="checkbox"/>	h. 8 <input type="checkbox"/>	i. 9 <input type="checkbox"/>
12. Finds quotients from a number line ☐
13. Uses the symbol $\overline{)}$ for division ☐
14. Uses the standard form (algorithm) ☐
15. Finds remainders ☐
16. Solves one-step problems using division ☐

Measurement

Area

1. Understands the concept ☐
2. Counts square units ☐
3. Finds area by counting square centimetres ☐
4. Recognizes the symbol cm^2 ☐

Capacity

1. Recognizes the term and its symbol:
 - a. litre (L) ☐
 - b. millilitre (mL) ☐
2. Estimates/Measures in litres ☐

Length

1. Recognizes the term and its symbol:

a. centimetre (cm) <input type="checkbox"/>	b. decimetre (dm) <input type="checkbox"/>
c. metre (m) <input type="checkbox"/>	d. kilometre (km) <input type="checkbox"/>
2. Estimates/Measures in centimetres ☐
3. Estimates/Measures in decimetres ☐
4. Estimates/Measures in metres ☐
5. Relates centimetres, decimetres, and metres ☐
6. Relates centimetres, decimetres, and metres using decimals ☐
7. Finds perimeter of a shape ☐

Mass

1. Recognizes the term and its symbol:
 - a. kilogram (kg) ☐
 - b. gram (g) ☐
2. Estimates/Measures in kilograms ☐

Money

1. Reads/Writes numerals and words for amounts of money less than \$50.00 ☐
2. Identifies cents as hundredths of a dollar ☐
3. Gives money values in cents ☐
4. Gives money values in dollars and cents ☐
5. Makes change ☐

6. Adds amounts, sums less than \$50.00 ☐
7. Subtracts amounts, differences less than \$10.00 ☐
8. Solves problems involving money ☐

Temperature

1. Reads/Records temperatures in degrees Celsius ☐
2. Recognizes the symbol $^{\circ}\text{C}$ ☐

Time

1. Writes numerals and words for times at five-minute marks ☐
2. Reads times on dial/digital clock to one minute ☐
3. Writes numerals and words for times at one-minute marks ☐
4. Names the days of the week in sequence ☐
5. Names the months of the year in sequence ☐
6. Finds/Reads days/dates from a calendar ☐

Volume

1. Finds volume by counting cubic centimetres ☐
2. Recognizes the symbol cm^3 ☐

Graphing

1. Reads pictographs ☐
2. Draws pictographs ☐
3. Reads bar graphs ☐
4. Completes bar graphs ☐
5. Gathers information for bar graphs ☐
6. Completes simple line graphs ☐

Problem Solving

1. Solves problems without using numbers ☐
2. Draws pictures and diagrams ☐
3. Identifies relevant information ☐
4. Identifies irrelevant information ☐
5. Recognizes answers as reasonable ☐
6. Solves problems by trial and error ☐
7. Identifies/Finds missing information ☐
8. Solves problems having more than one solution ☐
9. Solves one-step problems ☐
10. Solves two-step problems ☐

Geometry

1. Draws/Compares line segments ☐
2. Recognizes plane shapes and their properties:

a. circle <input type="checkbox"/>	b. hexagon <input type="checkbox"/>	c. octagon <input type="checkbox"/>
d. pentagon <input type="checkbox"/>	e. rectangle <input type="checkbox"/>	f. square <input type="checkbox"/>
g. triangle <input type="checkbox"/>		
3. Recognizes in plane shapes:
 - a. similarities ☐
 - b. differences ☐
4. Identifies/Draws symmetrical plane shapes ☐
5. Identifies/Draws lines of symmetry ☐
6. Identifies images of shapes for
 - a. flips ☐
 - b. slides ☐
 - c. turns ☐
7. Creates patterns using slides ☐
8. Recognizes solid shapes and their properties:

a. cone <input type="checkbox"/>	b. cube <input type="checkbox"/>	c. cylinder <input type="checkbox"/>
d. prism <input type="checkbox"/>	e. pyramid <input type="checkbox"/>	f. sphere <input type="checkbox"/>
9. Recognizes in solid shapes:
 - a. similarities ☐
 - b. differences ☐
10. Identifies/Counts in solid shapes:
 - a. vertices (corners) ☐
 - b. edges ☐
 - c. faces ☐
11. Associates ordered pairs of numbers with:
 - a. positions in an array ☐
 - b. points on a grid ☐

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